JUNE, 1955

# Industry & Welding

*If You're Going to the Show - - -*

**READ THIS ISSUE** to plan your visit. Check for exhibitors, what they're showing—and where. Note the technical program, speakers and locations—and schedule your activity to make the most effective use of your time.

*If You Cannot Attend - - -*

**READ THIS ISSUE** to learn what was shown, what was discussed, and what's new in processes, equipment and procedures.

*In Either Case - - -*

**READ THIS ISSUE** for the following valuable editorial Features:

**$CO_2$—A Shielding Gas?....59**

**You Can Braze Titanium....62**

**How to Grind Stainless Steel .....78**

**The DC Rectifier Welder....86**

***and many others.***

FRANCHISE CIRCULATION

**Complete Technical Program.....Page 105**
**What to See at the Show.....Page 108**
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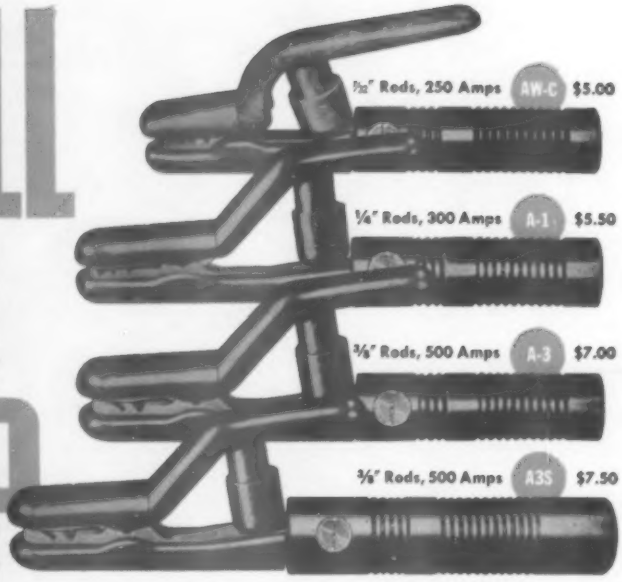



Jackson holders have long been in the lead, not only in the number of electrode holders sold, but on the basis of *quality*. Those shown here are made of a superior, 98% copper alloy, heat treated for greater strength, hardness and conductivity.

Independent laboratory tests show the following comparison between these Jackson Electrode Holders and two competitive makes, also made of copper alloy.

| | Tensile Strength lbs. per sq. inch | Elongation | Hardness Rockwell 'B' | Electrical Conductivity |
|---|---|---|---|---|
| JACKSON | 70,000 | 2% | 70 | 35% |
| Make "B" | 25-30,000 | 10-20% | 6-7 | 25-30% |
| Make "C" | 25-30,000 | 10-20% | 10 | 16% |

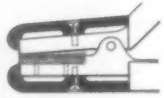
The Jacksons won on all points: *higher tensile strength*, to take almost any abuse; *lower elongation*, to hold their shape; *greater hardness*, to take the wear and tear between the jaws; *more conductivity* to take the current with a minimum loss.

All this, plus *thorough insulation*, improved time and again for greater strength, and *lowest-cost replaceable* parts, quickly installed to insure long life, make these Jackson holders the best buy for rugged, economical performance.

## EXTRA

**For even longer economical performance, Jackson offers holders similar to models A-1, A-3, and A-3S, shown above, with the added feature of replaceable lower jaws.**

**Model AA-1.....$ 6.50**
**Model AA-3.....$ 8.00**
**Model AA-3S.....$ 8.50**



**All Prices Lower in Quantity**

***Your Jackson Dealer will be glad to show you these and many other Jackson Electrode Holders. Also ask for the improved Ground Clamps and the latest in Jackson Welding Helmets and Safety Hats.***

**JACKSON**
PRODUCTS, INC.
WARREN · MICHIGAN

WORLD'S LARGEST MANUFACTURER OF ELECTRODE HOLDERS

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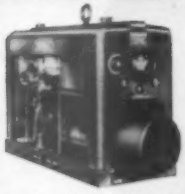
**The HOBART 300 amp. electric** drive DC welder has superior performance and true economy. It's designed especially for your average requirements in production, maintenance, repair, tool room work and general shop welding.

WHEN IT COMES TO EQUIPMENT DESIGNED TO

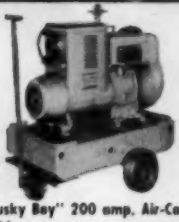
# Cut Your Costs

THIS NEW HOBART WELDER IS THE **GREATEST!**

*. . . and there's a Hobart to meet every requirement*



**"Contractors Special" 250 amp. DC Welder.** Designed for the profitable outside jobs. Lightweight, compact for handling and easy moving. It has a hot, fast, dependable arc and plenty of engine power.



**"Husky Boy" 200 amp. Air-Cooled Welder.** A low investment, lightweight air-cooled welder for general shop and outside repair work. It can be mounted on your pickup truck to quickly get to emergency repair work.

**"Bantam Champ" 250 amp. Electric Drive Welder.**

This modified multi-range type welder is a popular model in the light to medium 200 amp. class particularly where light weight and low cost are of prime consideration.

## Hobart Brothers Co., Box HW-65

**Troy, Ohio. Phone 21223** *"One of the world's largest builders of arc welding equipment"*

Try Hobart electrodes—a comparison will prove you get more top quality welding per day. Hobart electrodes are made for every application of AC or DC welding. Tell us the type of work you do and we'll send you FREE samples.

Without obligation, please send me complete information on items checked below.

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NAME_____ POSITION_____

FIRM_____

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CITY_____ STATE_____

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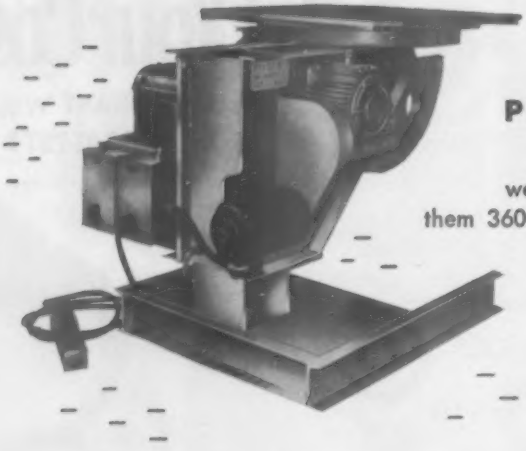
# POWERIZE YOUR WELDING JOB *FOR SPEED-PRECISION-SAFETY...*



## PANDJIRIS POSITIONERS

... POWER to tilt your weldments 135° and rotate them 360° for downhand welding. 3,000 lb. model shown.

**Capacities up to 140,000 lbs.**

**See you at Booth 245 Kansas City Welding Show June 8-10**

## PANDJIRIS TURNING ROLLS

... POWER to turn cylinders continuously for circumferential seams ... to position them for horizontal welds. No crane or manual work! Pandjiris builds 'em right ...

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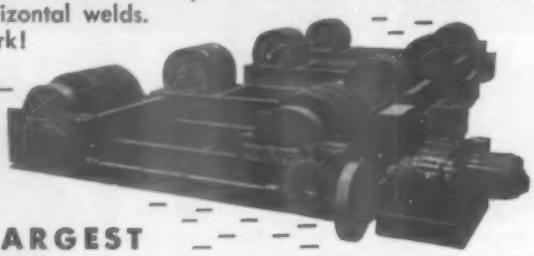

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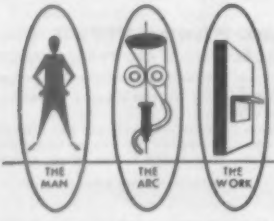


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# pandjiris weldment co.

DESIGNERS AND MANUFACTURERS OF PRODUCTION WELDING EQUIPMENT
5151 NORTHRUP AVE., ST. LOUIS 10, MO., U. S. A.

*efficient positioning of all three*

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# THE ALL NEW Weldit DUO-TROL Regulator

**DESIGNED TO MEET THE EXACTING REQUIREMENTS OF MODERN INDUSTRY**

Rugged—forged body and bonnet with steel bushing, precision built. Dependable—steady flow at all working pressures.

Safe—safety control automatically resets itself. Full view gauges.

***SUPER SENSITIVITY***

The Duo-Trol gives the highest degree of accuracy for:

- **Welding**
- **Cutting**
- **Heating**

Equally adaptable for both Light and Heavy Duty work.

Weldit INC.
SINCE 1918

990 OAKMAN BLVD.
DETROIT 38, MICHIGAN

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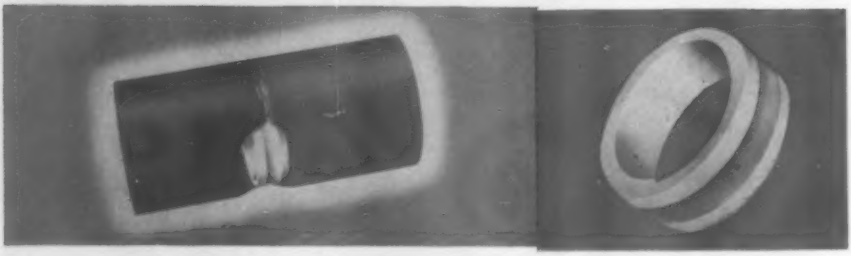
Better pipewelds FASTER!

with new **CERAMIC**

PYROTONE

**BACKING RINGS**

- IMPROVE WELD QUALITY
- SPEED WELDING PRODUCTION
- REQUIRE LESS SKILL
- EASILY REMOVED WHEN WELD IS COMPLETED
- ADAPTABLE FOR FIELD OR SHOP ERECTION
- WITHSTAND ROUGH HANDLING



PYROTONE Ceramic Backing Rings, "heat engineered" to withstand high arc temperatures, insure proper root fusion. They reduce "test failures," speed welding operations, lower the cost of fabrication, and are completely and easily removable from pipe.

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# Industry & Welding

JUNE, 1955

VOL 28 No. 6

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BPA

MEMBER
American Welding Society
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International Acetylene Association

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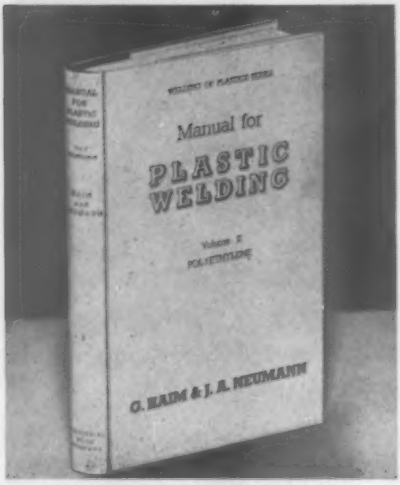


**VALUABLE NEW DATA**

During the last few years gas welding of plastics has been applied with particular success to a large and ever-increasing variety of constructions where it has proved invaluable. Information on this subject is rather scarce. This manual will be extremely valuable to practical welding people and to engineers who intend to incorporate plastic materials into their designs.

**PRICE $6.00**

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1240 ONTARIO STREET
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**1 LIGHTER!**

Less torch weight lets operators work faster with less fatigue because it's easier to handle. This all new Marquette torch weighs one-third less than ordinary torches because its handle is made of light, high-strength aluminum alloy.

**2 STRONGER!**

It stays on the job. Spring loaded telescoping valve stems are protected even if torch is dropped. Rib re-enforced anodized aluminum handles withstand abuse and corrosion. Threads on tough, stainless steel torch head resist wear from changing tips and damage from careless handling.

**3 COOLER!**

Torch handles stay comfortably cool, keeping operators on the job with fewer work breaks. Overheated handles are completely eliminated because the stainless steel torch head is seven times less heat conductive than brass heads used in other torches.

**COMPLETE NEW LINE**

Four new torch models for welding and cutting all metal thicknesses are available: SUPER-JET, AERO-JET, STAR-JET and JET-O-MATIC. All four torches have fast change O-ring seals, eliminating old type hard to service gas seals . . . a positive gas-tight connection of tip to handle is made instantly with finger twist pressure.

**Send for New Brochure**

Learn why these new torches will do a better welding job for you. *Write today!*

*When It Comes to Welding Come to*

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**WELDING EQUIPMENT**

MARQUETTE MANUFACTURING COMPANY, INC.

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VICKERS®

Controlarc

MAGNETIC AMPLIFIER-RECTIFIER

FULL TIME,

**INDIVIDUAL CONTROL of both current and voltage**

- EASY, CLEAN ARC STRIKES
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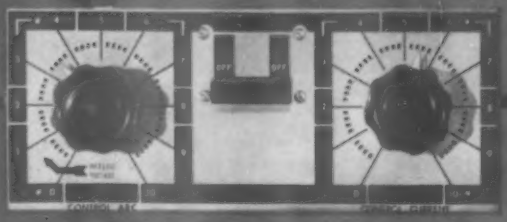
- NO ARC "POP OUTS"
- NO CURRENT DROP-OFF DURING PASS
- UNIFORM FUSION, STEADY RATE OF METAL DEPOSIT

**PATENTED VICKERS MAGNETIC AMPLIFIERS**

CONTROLARC automatic control is made possible by the patented Vickers Self-saturating Magnetic Amplifier with exclusive voltage-sensing, feed-back control circuits. Constantly analyzing welding voltage and automatically adjusting welding current to arc changes, Vickers Magnetic Amplifier maintains ideal arc characteristics, through the entire welding range, under all welding conditions.



VOLTAGE and CURRENT INDIVIDUALLY CONTROLLED

Only Vickers Controlarc offers complete remote control of both voltage and current through the entire welding range. The operator never has to go to the welder to change range settings or taps. Two separate dials individually control voltage and current.

Separate, complete control of both voltage and current makes it possible to set any volt-ampere combination within the output range of the particular Controlarc model being used — from minimum voltage at minimum current to maximum voltage at maximum current.

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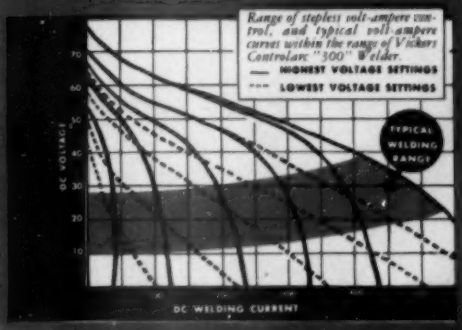
# DC Welder 200 300 400 AMPERE MODELS

## AUTOMATIC ARC CONTROL

**FULL RANGE VOLTAGE CONTROL . . .**

. . . separate from current control, makes it possible to choose the exact arc characteristic for every job and every welding condition. Controlarc full range, stepless voltage control is not limited to a few "average" settings, with blind spots in between. With Controlarc voltage control, the weldor not only can select the arc characteristic for a basic welding position—flat, overhead or vertical—but can pinpoint the setting to his personal preference for the particular condition under which he is welding.


Range of stepless volt-ampere control, and typical volt-ampere curves within the range of Vickers Controlarc "300" Welder.
— HIGHEST VOLTAGE SETTINGS
--- LOWEST VOLTAGE SETTINGS
TYPICAL WELDING RANGE
DC VOLTAGE
DC WELDING CURRENT

## VICKERS CONTROLARC DC WELDER
### Construction Features

DOWNDRAFT COOLING
*No "vacuum cleaner" floor dust pickup*

RUST PROTECTED
*Interior surfaces zinc chromated*

RECTIFIERS
*Conservatively rated for long life. Special finish protects from corrosive atmospheres*

SEALED-IN LUBRICATION OF FAN MOTOR BEARINGS

DUCT COOLED TRANSFORMER
*Air ducts in windings for high-efficiency cooling*

CONCENTRATED WEIGHT
*Low center of gravity*

SKID MOUNTED
*Portable mounting available*

**NO MOVING CORES OR COIL ASSEMBLIES—NO GEAR OR OTHER MECHANICAL DRIVES—ALL PARTS QUICKLY AND EASILY ACCESSIBLE**

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**VICKERS ELECTRIC DIVISION**

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# INVINCIBLE
## *Flux Recovery Systems*

Fully Automatic
Model 482.

Portable
Model 480.

**Save VALUABLE FLUX**—Invincibles recover all unfused flux from the work, remove fine dust and fused particles, return slag-free, dust-free, fusible flux to the hopper of the welder.

**Eliminate COSTLY MAN-HOURS**—Invincibles do the whole job, more rapidly and efficiently than manual methods.

**Reduce EXPENSIVE REJECTS**—By removing all fine dust (flux flour), Invincibles reduce welding rejects and step-up production.

***Write for Folder on Invincible Flux Recovery Equipment.***

**INVINCIBLE VACUUM CLEANER MFG. CO.**
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OVER 50 YEARS THE LEADER IN INDUSTRIAL VACUUM EQUIPMENT

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# the only all position iron powder low hydrogen electrode...

## ATOM•ARC

- X-ray quality weld metal.
- No starting porosity.
- More pounds of weld metal per electrode used.
- Outstanding physical properties.
- Smooth, uniform weld bead in all positions.
- No moisture pick up.

ATOM ● ARC is available in the strength levels and chemistry of the following AWS grades:

7016
8016N (3½% Ni.)
8016CM (1¼% Cr., ½% Mo.)
9016CM (2¼% Cr., 1% Mo.)
10016MM (1.70% Mn., .40% Mo.)

*Visit our Booth 227 at Welding Show, Municipal Auditorium, Kansas City, June 8-10, 1955.*

*Write today for the complete story on new ATOM ● ARC... the finest iron powder low hydrogen electrode made.*

Alloy Rods Co.

**General Offices and Plant**
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**750 Lairport Street**
**EL SEGUNDO, CALIFORNIA**

**Circle No. 9 on Reader Service Card.**

# NEWS of the WELDING INDUSTRY

## Metal & Thermit Appoints New Executive Advisor

Merritt L. Smith has been appointed Executive Advisor of Metal & Thermit Corp., it was announced by H. E. Martin, President. As staff coordinator, Mr.

Smith will assist the president in integrating the company's varied sales activities.

Mr. Smith's experience covers more than 20 years in sales administrative work concurrent with advertising. He was for four years Assistant General Sales Manager, and prior to his present appointment was Manager of Advertising and Sales Promotion.

## Coyne Cylinder Builds New Memphis Building

To better serve southwest, southeast, midwest and eastern markets, Coyne Cylinder Co. has erected a 14,000 square foot building in Memphis, Tenn. The new building has air conditioned sales offices and manufacturing facilities. In addition, the plant has a six car spur track and 18,000 square feet of yard space.

The firm's other location is its acetylene cylinder manufacturing plant in San Francisco.

## R.W.M.A. New Members

Resistance Welding Manufacturers' Association has announced that Progressive Welder Co., Detroit, and United Welders, Inc., Bay City, Mich., have become members of that organization. This brings total membership in the group to 15.

The Association is currently under the leadership of J. C. Wilson, Jr., Acro Welder Mfg. Co., who was recently elected president.

## Franklin Balmar Elects Officers

Directors of Franklin Balmar Corp., Baltimore, have announced election of John N. Merkle, formerly president, as vice chairman of the Board of Directors. Julius J. Kirchhof, formerly executive vice president, succeeds Mr. Merkle as president.



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# WE SOLVE MORE WELDING PROBLEMS

● A call to BURDOX can save you hours of time on your welding and cutting jobs . . . time-saving that is important today because it means savings on manpower . . . materials . . . costs. We save your time because we can tell you which product or process will give you the best results in the fastest time . . . because we can supply all your needs for welding and cutting at one time . . . because we give you the benefits of our experience with every welding method. Since the BURDOX line provides products for all the processes, we have no "favorites" — we recommend what we know from experience will do your work best. Isn't this triple saving worth calling BURDOX on your welding needs? Or better still — write for your FREE catalog NOW!

*Every Product . . . every Process to fit every Purpose Best!*

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Firm .....

Address .....

City ..... Zone ..... State .....

**MAIL COUPON TODAY!**

**THE BURDETT OXYGEN CO.**

**3333 LAKESIDE AVENUE**

**CLEVELAND 14, OHIO**

**PLANTS: Cleveland, Dayton, Mansfield, Youngstown, Ohio & Los Angeles, California**

**BRANCHES: Akron, Cincinnati, Columbus, Ohio**

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PRECISION WELDING
demands the accuracy of a

Challenge®

SEMI-STEEL
WELDING TABLE

Spot, arc, or heavy-duty welding! Challenge Semi-Steel Welding Tables stand up to **any job, in any plant.** Provide a true, rigid more convenient surface. T-Slot construction. In 3 standard sizes. Multiple units of special sizes may be mounted into one large unit.

793

**CHALLENGE** also manufactures a complete line of auxiliary welding equipment including Cast-Iron Work Benches, (shown), Semi-Steel or Clovis-Black Granite Surface Plates, Checking Tables, Bench Plates and Adjustable Floor Plates.

Write for full details to
THE CHALLENGE MACHINERY CO.
Office, Factories and Show Room
GRAND HAVEN, MICHIGAN

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## Lincoln Names Stringham Engineering Vice President

Appointment of L. K. Stringham as Vice President in charge of Engineering was recently announced by Lincoln Electric Co., of Cleveland. Chief Engineer since 1951, Stringham replaces George Landis named Vice President in charge of Research.

Upon his appointment, Stringham named two chief engineers. Norman J. Hoenie was appointed Chief Engineer, Machine Division, and Emmett Smith was named Chief Engineer, Electrode Division. Both had been assistant chief engineers of their respective divisions.

## Ampco Metal Appoints New Distributors

Ampco Metal, Inc., has announced appointment of several exclusive distributors of their bronze welding electrodes, rods and filler metals.

Named were Pacific Metals Co., Ltd., San Francisco and Los Angeles; Arizona Welding Equipment Co., Flagstaff; McDonald & Wilson Sales Co., St. Louis; Miller Equipment Co., Cincinnati, and Red Arrow Sales Corp., Madison, Wisconsin.

Named to handle the company's resistance welding electrodes and alloys was the General Distributing Co. of Great Falls, Montana.

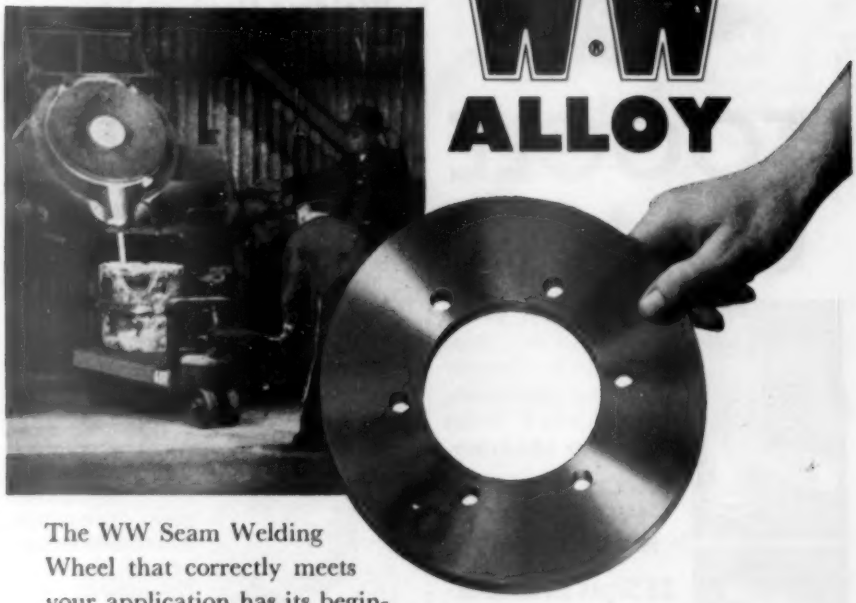
City ..... Zone ..... State .....

MAIL COUPON TODAY!

PLANTS: Cleveland, Babylon, Wadsworth, Youngstown, Ohio & Los Angeles, California

BRANCHES: Akron, Cincinnati, Columbus, Ohio

# FIRST . . . it's a WW ALLOY



The WW Seam Welding Wheel that correctly meets your application has its beginning in the *premium quality* WW alloy from which it is made.

We make the alloys right from the beginning; we know they are right. Right in strength, right in hardness, right in electrical conductivity, right for better wear and right for better welds.

WW's specialized skill and production facilities assure you Seam Welding Wheels of uniform dependability for strong, clean welds; long production runs; minimum downtime. Standard blanks from stock . . . specials to order: supplied finished or rough for your own machining.

***Write today for this free informative WW manual***

W552

**WW ALLOYS, INC.**

*Division of Fansteel Metallurgical Corporation*

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Home of Premium Quality Alloy Castings and Forgings

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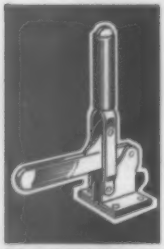
WESPO

# TOGGLE CLAMPS



**Hardened steel bushings and pins provide for longer wear — eliminate elongated holes and pin shearing.**

**A CLAMP FOR EVERY WORK HOLDING NEED**

***35 Sizes Available***

WESPO TOGGLE CLAMPS are engineered and constructed for positive holding and light, medium and heavy clamping.

**West Point Mfg. Co.**
26941 W. SEVEN MILE RD.
DETROIT 19, MICHIGAN

**WRITE FOR FREE TEMPLATE CATALOG**

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## Hopper Heads G. E. Welding Dept. at York

Douglas A. Hopper has been named General Manager of General Electric's Welding Department at York, Pa., it was announced recently. Mr. Hopper succeeds Raymond C. Freeman, who has been appointed manager, Engineering and Operations, Atomic Power Equipment Department, at Schenectady.

## A.I.S.E. Appoints Manager for Industrial Sales Division

Appointment of Donald T. O'Shea as Manager of Industrial Sales Division was announced recently by William H. Loveman, president, American Industrial Safety Equipment Co., Cleveland, Ohio. A member of the American Society of Safety Engineers, Mr. O'Shea has had a number of years of experience in the industrial safety field, dealing with industrial concerns, utilities and railroads and concentrating on head and eye protection devices.

## Alloy Rods Appoints New Distributors

Appointment of two new distributors to represent the company in their respective areas has been announced by E. R. Walsh, III, vice president in charge of sales for Alloy Rods Co., York, Penna. Named were Peerless Supply Co., Inc., Shreveport, La., and Sanders and Stewart, Inc., Jackson, Mich.

More News on Page 154

# FOR LOW-COST PRODUCTION SOLDERING

Low-cost, basic outfit includes fully adjustable, pressure regulator and precision handle for complete flame control and gas economy.

## *Prest-O-Lite* Trade-Mark Air-Acetylene Equipment

Whatever your soldering, heating, and brazing needs, there's a PREST-O-LITE outfit to meet your exact requirements. Because you "tailor-make" your own. You have:

**YOUR CHOICE** of standard torch handle or precision model with gas-saving shutoff valve and built-in pilot flame control. All stems fit interchangeably on either handle.

**YOUR CHOICE** of seven open flame stems in job-matched sizes for everything from heavy heating to fine electrical soldering; pointed or chisel type soldering iron stems for use where an open flame is not practical.

**YOUR CHOICE** of operating from small portable tanks, standard cylinders, or industrial piping systems.

Ask your LINDE jobber for a demonstration. Or write LINDE AIR PRODUCTS COMPANY, a Division of Union Carbide and Carbon Corporation, 30 E. 42nd St., New York 17, N. Y. In Canada: Dominion Oxygen Company, Division of Union Carbide Canada Limited, Toronto.

## Get it from your LINDE jobber

*The terms "Linde" and "Prest-O-Lite" are registered trade-marks of Union Carbide and Carbon Corporation.*

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**You'll be glad you did!**

**We want to give you a copy of Sylvania's Welding Guide**

**. . . and tell you about Sylvania Tungsten Welding Rods**

## 1955 A.W.S. WELDING and ALLIED INDUSTRY EXPOSITION

THESE THREE top-quality Sylvania Tungsten rods will handle any inert gas welding job that comes your way. Each rod is especially designed to meet conditions you will encounter in atomic hydrogen, helium and argon arc welding.

Order Sylvania Tungsten Electrodes in handy packages of ten from your welding supplies distributor. For technical information, write to:

SYLVANIA ELECTRIC PRODUCTS INC.
1740 Broadway, New York 19, N. Y.
*In Canada:*
*Sylvania Electric (Canada) Ltd.*
*University Tower Bldg., Montreal.*

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Lighting • Radio • Electronics • Television • Atomic Energy

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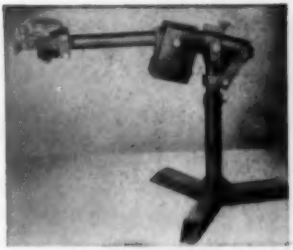
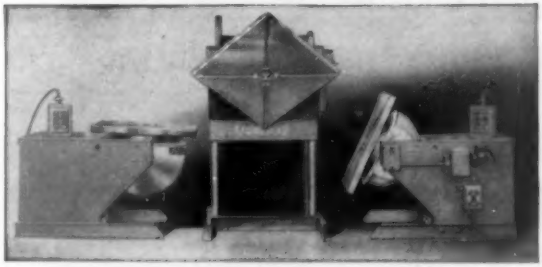
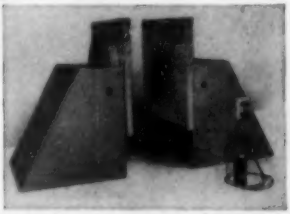
# Steady, Positive, Precision Rotation for AUTOMATIC WELDING with *Aronson* Positioning Equipment.



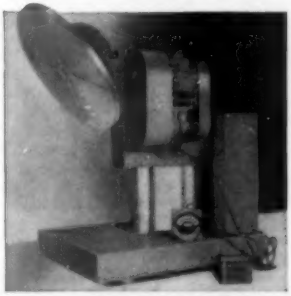
**UNIVERSAL Balanced POSITIONING**
Model C 500 shown
25 lbs. to 2,000 lbs. capacity



**HEAVY DUTY GEAR DRIVEN POSITIONING**
Model HD 25 shown
500 lbs. to 24,000 lbs. capacity



**HEAD and TAIL STOCK POSITIONING**
Model HTS 5 shown
Capacities 5,000 lbs. to 160,000 lbs.



**MODEL 21** (shown) SUPER GEAR DRIVEN POSITIONER with powered rotation tilt and elevation.

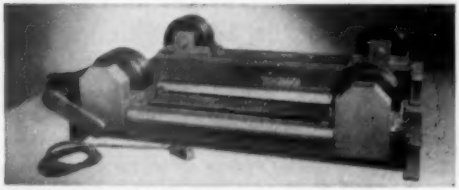
**MODEL X-21** Powered rotation, ball bearing manual tilt and elevation.

**MODEL 21-P** Powered rotation and tilt, ball bearing manual elevation.

**MODEL 21-E** Powered rotation and elevation, ball bearing manual tilt.

**MODEL X-21-PE** Powered rotation, tilt and elevation.
5000 lbs. capacity @ 6" CG location.

**Aronson TRACTRED Turning Rolls**
Steady, positive, precision rotation for automatic welding. **MODEL T1** (shown) capacity 6,000 lbs. per unit. **MODEL T2** capacity 12,000 lbs. per unit. **MODEL T3** capacity 18,000 lbs. per unit.



**HEAVY-DUTY PRECISION BUILT RUBBER TIRED TURNING ROLLS**
5,000 lbs. to 150 tons capacity

*Aronson* MACHINE COMPANY
ARCADE, NEW YORK

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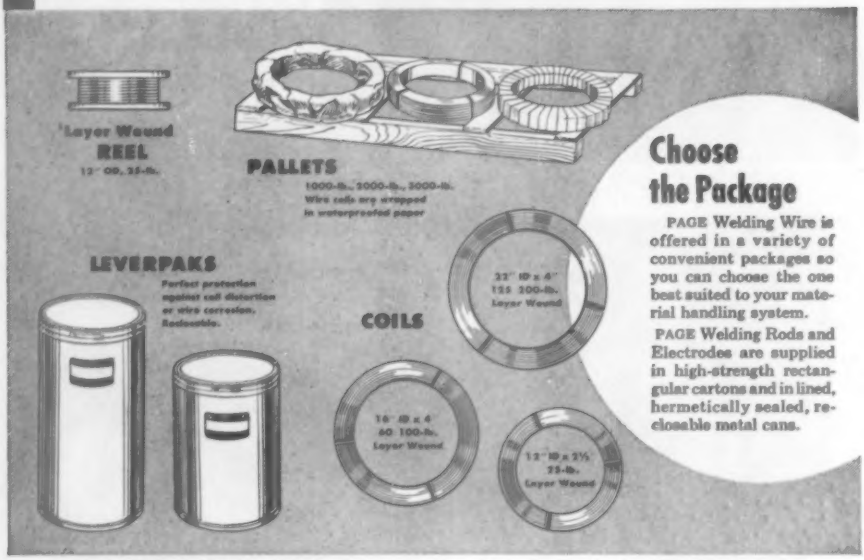
ACCO Quality

- Most popular welding wires
- A variety of convenient packages

plus

- Availability from local stocks




**Choose the Wire** The complete PAGE line includes a wide range of analyses in automatic welding wire, metal spray wire, bare electrodes, and gas welding rods.

**PAGE DISTRIBUTORS all around the country carry stocks for quick pick-up. This saves long lead time in ordering as well as a big inventory investment. See your PAGE distributor today or write our Monessen, Pa., office for literature.**

ACCO

Page Steel and Wire Division
AMERICAN CHAIN & CABLE

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for Better Value

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# ALWAYS *first Choice...*

***When advantages are considered...***

## HI-AMP ELECTRODE HOLDERS

Whenever a major welding project is in Progress, Welders invariably depend on HI-AMP Electrode Holders — and here's why... • Completely enclosed insulated Spring — can't be knocked or shorted out. • Handle withstands higher temperatures. • Low Trigger cuts Operator fatigue. • Reversible Tip Insulators — long service. • Slender Tongs for tight places.

**Sold only through Welding Supply Distributors throughout the U.S. and Canada.**

**WAGNER MANUFACTURING CO. Inc., JACKSON, MO.**

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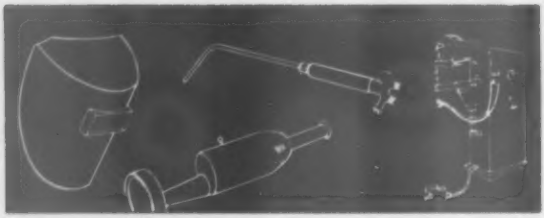
# index to products advertised this month



This index, compiled for easy reference represents only those products advertised in this issue about which information was available prior to our closing date. All of our advertisers, however, are prepared to supply full particulars regarding their equipment, services and materials.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# ARMOR-TUF

## THE AMAZING NEW STEEL HARDENING COMPOUND

**"ARMOR-TUF hardens tools and steel parts as easily as baking pie, and much more quickly."**

*Now used by leading steel processors and other manufacturers everywhere!*

You can use milder, cheaper steels for many applications and machine them before hardening. The saving is two-fold: less expensive steels and lower machining costs. ARMOR-TUF gives low carbon steels the cutting and wearing properties of tool steels. You can harden the softest steels to a degree ordinarily obtainable only in high priced steels.

Service between sharpenings increased 10 times and more. Tools hardened with ARMOR-TUF hold their edges many times longer. The advantages: substantially reduces resharpening costs . . . saves on time lost changing dull tools . . . keeps tools in service . . . enables increased production as result of less frequent tool changing and sharpening.

As compared with the usual heat treating processes, the saving in time is great. Instead of hours, only minutes are needed. The entire hardening process takes less than ten minutes

No CYANIDE, Absolutely — ARMOR-TUF is safe to use, contains no cyanide of any kind or other toxic ingredients.

**ARMOR-TUF IS UNCONDITIONALLY GUARANTEED TO INCREASE THE LIFE OF TOOLS AT LEAST 300%, OR YOUR FULL PURCHASE PRICE WILL BE REFUNDED.**

**ARMOR-TUF SALES CORPORATION**

**299 Madison Avenue - New York 17, N. Y.**

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ALL ACETYLENE CYLINDERS ARE *NOT* ALIKE!

COYNE

QUICK CHARGING
**ACETYLENE CYLINDERS**
ARE QUALITY ENGINEERED FOR
**SAFETY ◆ DURABILITY ◆ CAPACITY**

No, all acetylene cylinders are not alike. COYNE cylinders—seamless or welded are better—are precision built. COYNE cylinders with curled under protective shield fit snugly together, handle easier in shop or truck. COYNE designed flange eliminates voids under valve and fuse plug holes. Available in capacities from 10 to 320 cubic feet.

Write for Descriptive Literature.

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**COYNE CYLINDER CO.**
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**See us at Booth 207, A.W.S. Welding Show, Kansas City, Mo., June 8-10**

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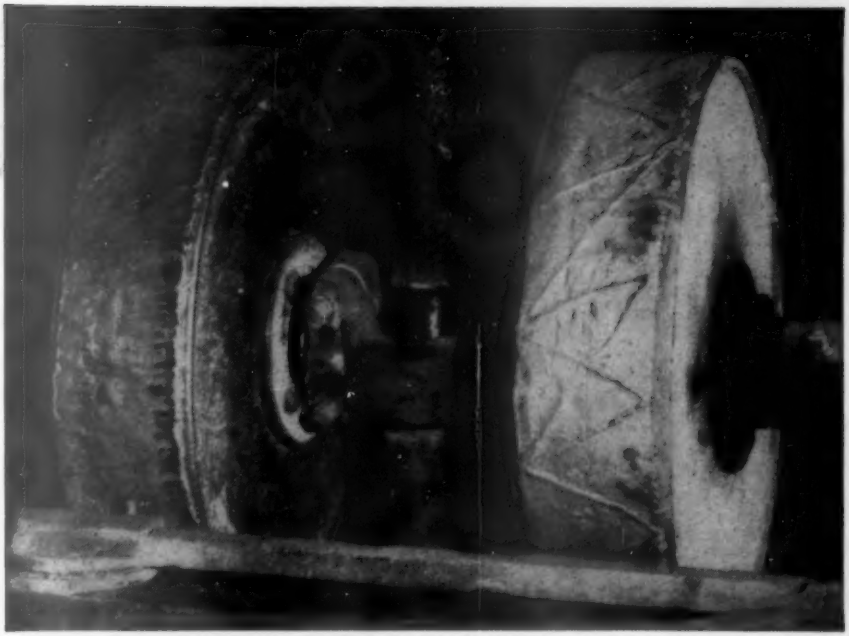

# 14 Times the LIFE... by ***Hard-Facing***

The hard-faced rolls on this rock-crusher mill have been in constant operation for 6 years. During this time, the rolls have been pulverizing such abrasive materials as ferro-alloys, ore, dolomite, feldspar, rock, and sand. Unprotected rolls had to be replaced every 4 to 5 months.

There are 14 HAYNES hard-facing alloys . . . each developed to give top resistance to certain conditions of wear. Use them to protect metal parts from abrasion, corrosion, impact, erosion, or heat. All alloys are quickly and easily applied with standard welding equipment.

Ask your local Haynes Stellite dealer for literature describing these rods. If you don't know your local dealer, write to Haynes Stellite Company, a Division of Union Carbide and Carbon Corporation, Kokomo, Indiana.

*See...* **Your local Haynes Stellite Dealer**

*or*

*Write...* **to Haynes Stellite Company**

"Haynes" and "Haynes Stellite" are registered trade-marks of Union Carbide and Carbon Corporation.

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Circle No. 22 on Reader Service Card.

"FASTEST CUTTING EVER"
"PRODUCTION UP 3 TIMES"
"FAR SUPERIOR TO OTHER DISCS"
"SEND US 150 MORE . . . IMMEDIATELY"
"WONDERFUL ON STAINLESS WELDS"
"YOU'VE REALLY GOT A PRODUCT"
"TERRIFIC ON ALUMINUM"

FROM field tests come these and hundreds of other enthusiastic customer reports about "BF" . . . the new Reinforced Resinoid disc-wheels that are a sensation in the weld grinding field.

These BAY STATE "BF" discs are sharper, do cut faster, remove more stock, and last longer too! . . . but you'll have to see them in action to believe it.

Order trial wheels, or ask for an actual demonstration now.

**BAY STATE ABRASIVE PRODUCTS CO., Westboro, Massachusetts, U.S.A.**

Branch Offices and Warehouses—Bristol, Conn.; Chicago, Ill.; Cleveland, Ohio; Detroit, Mich.; Pittsburgh, Pa. Distributors — All principal cities
In Canada: Bay State Abrasive Products Co. (Canada) Ltd., Brantford, Ont.

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MAIL TO YOUR LOCAL DISTRIBUTOR OR TO WESTBORO, MASS.

Please arrange a demonstration of your new "BF" Disc Wheels

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COMPANY _____

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CITY _____ STATE _____

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# Dockson "HI-SPEED" WELDING AND CUTTING TORCHES

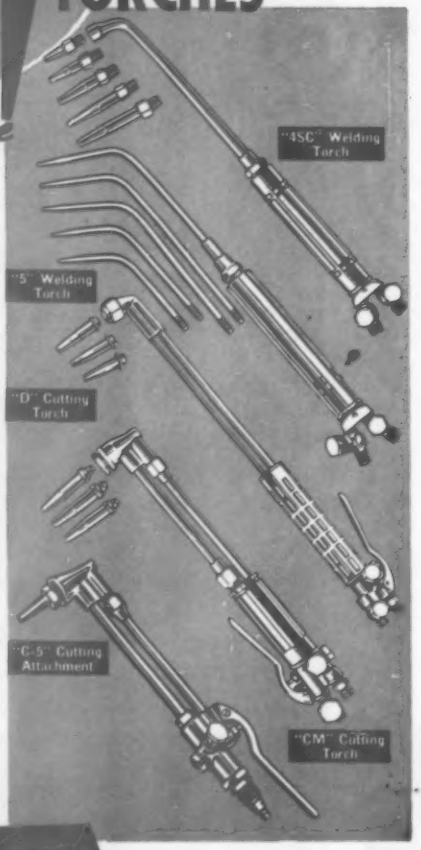
*Built for Better Service*

**SOUNDLY DESIGNED**—Dockson Torches were developed by welding and cutting specialists to handle your needs—quickly, easily, and economically.

**CAREFULLY MANUFACTURED**—Dockson Torches are built of the finest materials for long life and dependable operation. They incorporate a new, longer life, better seal compound developed especially for oxy-acetylene service in both mixer and union rings. Dockson's two-ring construction means fewer rings to replace, stronger construction.

**DOUBLE LIFE**—Dockson Torches take standard, stock replacement parts that fit like the originals.

**YOUR DOCKSON DISTRIBUTOR**—a selected specialist, stocks a complete line of Dockson products to give you fast service and personal attention. We back our distributors 100%.




3839 Wabash
Detroit 8, Mich.

Dockson CORPORATION

WRITE FOR YOUR DISTRIBUTOR'S NAME AND OUR COMPLETE CATALOG OF WELDING AND CUTTING EQUIPMENT.

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## *for faster, cleaner, sounder welds use*
## CRUCIBLE STAINLESS ELECTRODES...

You're *sure* of fast deposition—uniform quality welds—with Crucible stainless steel electrodes. For Crucible pioneered in the *development* of stainless electrodes . . . and its welding engineers have a wealth of manufacturing and application experience for you to draw upon.

And you'll find a complete assortment of Crucible stainless bare welding rods and coated electrodes for both AC and DC welding . . . including special high carbon corrosion- and heat-resisting electrodes . . . armorize electrodes for armor plate welding . . . electrodes for cast iron welding.

Whatever your application . . . whatever welding procedure you use . . . there is a Crucible stainless welding wire or electrode for the job. You'll get them *fast* from your nearest Crucible warehouse, or from leading welding equipment distributors. *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 30, Pa.*

**CRUCIBLE** first name in special purpose steels

**Crucible Steel Company of America**

Circle No. 24 on Reader Service Card.

# Literature Featured In Ads This Month

(CIRCLE ON ENCLOSED POSTCARD, NUMBERS OF LITERATURE YOU WISH TO RECEIVE)

**6** **Four new welding and cutting torches** for use on all metal thicknesses are featured in new brochure. MARQUETTE MFG. CO., INC. Page 7.

**7** **DC Rectifier welder** with full time automatic arc control is introduced in detailed catalog. VICKERS ELECTRIC DIVISION. Pages 8-9.

**8** **Flux recovery equipment** and case histories are included in folder. INVINCIBLE VACUUM CLEANER MFG. CO. Page 10.

**10** **Complete catalog of welding equipment and accessories is available.** BURDETT OXYGEN CO. Page 13.

**12** **Resistance welding alloys,** including seam welding wheels, are subject of informative manual. WW ALLOYS, INC. Page 15.

**13** **35 Varieties of toggle clamps are** featured in free bulletin. WEST POINT MFG. CO. Page 16.

**16** **Positive, precision rotation for automatic welding** is explained in catalog which featured complete line of positioning equipment. ARONSON MACHINE CO. Page 19.

**20** **Quick charging acetylene cylinders** are featured in descriptive bulletin. COYNE CYLINDER CO. Page 24.

**21** **14 Hard facing alloys** for a variety of uses are described in literature. HAYNES STELLITE DIV., Page 25.

**23** **Welding and cutting equipment** is featured in complete catalog. DOCKSON CORP. Page 28.

**25** **Face and eye protection** for welding operators is highlighted in bulletin featuring goggles, helmets and face shields. WELSH MFG. CO. Page 31.

**26** **Rebuilding tractor and shovel parts** with hardsurfacing materials is explained in special instruction material Form A6-1. RANKIN MFG. CO. Page 32.

**29** **Examples of low-cost metallizing applications** are contained in Bulletin 55. METALLIZING ENGRG. CO., INC. Page 35.

**30** **Advantages of cutting and gouging** with carbon-arc-compressed air torch is explained. ARCAIR CO. Page 36.

**32** **New line of heavy-duty industrial arc welders** is featured in new literature. MID-STATES WELDER MFG. CO. Page 38.

**36** **Oxy-acetylene cutting torches and tips** for every application are included in Catalog 818. AIR REDUCTION SALES CO. Page 43.

**38** **Small but powerful electric grinder** for weld finishing applications is featured in literature and price list. J & H PRODUCTS, INC. Page 46.

**43** **Power drivers for installing threaded stud units** in steel or concrete are featured. VELOCITY POWER TOOL CO. Page 52.

**45** **Resistance welding catalog** features complete line of electrodes, holders, seam welding wheels, die, forgings and castings. P. R. MALLORY & CO., INC. Page 58.

**48** **New automatic welding fixture** is introduced in catalog. LEWIS WELDING & ENGRG. CO. Page 70.

# WELSH-GUARDS

## for WELDERS

**Fit Comfortably Over All Corrective Glasses**

*WELSH-GUARD* Cover Goggles give ample clearance for wear over prescription glasses of *all* styles and types.

*Send Now for Full Information*

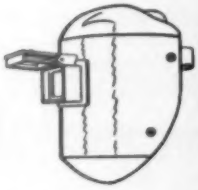
STYLE No. H 22

**Complete Line of Welders Face and Eye Guards**

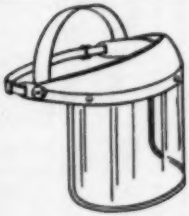
Style No. 1045

Style No. 1050

Style No. H 20



Style No. H 890 — 4C



Style No. F 120

Style No. H25X-4P

WELSH MANUFACTURING COMPANY
3 Magnolia Street, Providence, R. I.

*"Safeguard with Welsh-Guards"*

**See All WELSH-GUARD Products at BOOTH No. 202 American Welding Society Welding Show Kansas City Auditorium**

**Circle No. 25 on Reader Service Card.**

YOUR "CAT" HAS NINE LIVES
when protected with
Ranite
HARDSURFACING MATERIALS

Special instructions are available (form A6-1) explaining welding procedure for re-building tractor and shovel rails, rollers, sprockets, and idlers. Included are tractor parts specifications so you will know the exact finish weld dimensions. Contact your RANITE distributor or write to factory for your copy of this useful bulletin.

RANKIN MANUFACTURING CO.
3072 WEST PICO BLVD.
LOS ANGELES 6, CALIF.

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**52** **Gas shielded welding of mild and medium carbon** steels automatically with carbon dioxide shielding gas is introduced in free booklet. A. O. SMITH CORP. Pages 84-85.

**54** **32-Page Guide** lists more than 160 welding rods and electrodes. EUTECTIC WELDING ALLOYS CORP. Page 91.

**56** **Positioner catalog** explains why positioned welding can be cheaper. CULLEN-FRIESTEDT CO. Page 93.

**58** **Automatic brazing system** which fluxes brazing work automatically through fuel gas is explained in brochure. ALL-STATE WELDING ALLOYS CO., INC. Page 95.

**61** **71-page book** gives dimensions, weights and properties of hot rolled carbon steel structural shapes. U. S. STEEL SUPPLY DIV. Page 101.

**62** **Fluted welding cable,** which is light and flexible, is described in free folder. UNITED STATES RUBBER CO. Page 102.

**63** **Combination AC-DC welder** is introduced in Bulletin 1343. LINCOLN ELECTRIC CO. Page 123.

**65** **Efficient positioning and lifting** is subject of literature which features standard and specialized positioning and lifting devices. JAMES CAMPBELL SMITH, INC. Page 115.

**66** **Portable 200 amp welder** is featured in folder. KASSON DIE & MOTOR CORP. Page 116.

**68** **Powder cutting of problem metals** is explained in literature. Manual and machine cutting are covered. NATIONAL CYLINDER GAS CO. Pages 118-119.

**70** **New inconel electrodes** are introduced in Bulletin T-2. INTERNATIONAL NICKEL CO., INC. Pages 124-125.


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FORGINGS WERE BUTT-WELDED SINGLY—
FLASH WAS SHAVED OFF AND JOB BUFFED.

# FORD MOTOR

## increases strength of this assembly and...

## SAVES UP TO 20%

FOUR ASSEMBLIES ARE NOW BRAZED SIMULTANEOUSLY—
NO GRINDING AND BUFFING NECESSARY AFTER BRAZING.

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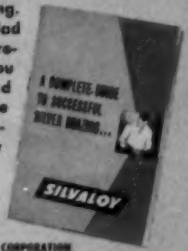
LOW TEMPERATURE SILVER BRAZING ALLOY

## PREFORMED RINGS ARE USED FOR THE JOB!

*SEND FOR FREE GUIDE TO SUCCESSFUL SILVER BRAZING*

**The successful combination of Ford Engineering and Silvaloy Brazing Alloy multiplies production efficiency for this Ford Transmission Gearshift Tube and Socket assembly—*with important savings in costs!* Formerly, single assemblies were butt-welded, the flash removed and joint buffed. Now, four assemblies are brazed simultaneously—without need for grinding or buffing after brazing. A Silvaloy Technician will be glad to assist in planning brazing production in your plant, to help you cut costs, improve results and speed production. Call or write today. There's no cost or obligation, of course. ★ ★ ★ ★ ★ ★ ★**

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# THE AMERICAN PLATINUM WORKS

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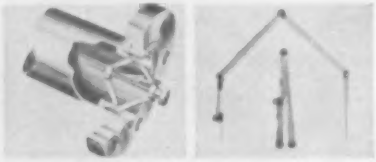
**LAYOUT PIPE JOINTS** (Ys, Ts, Ls or any angle joint) in minutes with the Contour Marker on any size pipe from 1½" to 48". Absolutely accurate. Two sizes: Standard for 1½" to 18" pipe; Jumbo for 16" to 48" pipe.

**MARK A CENTER LINE** at any angle on a pipe, with Boyce Centering Head. Leveling gauge on dial protractor establishes angle; hardened punch marks it.



**ALIGN PIPE AND FLANGE** (slip on, lap joint, stub-end & welding neck) with this expanding tool.

**MARK ANY ARC** or circle up to 48" with this folding, all metal 24" Radius Marker.

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*of California*

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SOLD BY WELDING SUPPLY DEALERS

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**75** **Grinding wheels, attachments and abrasive products** are featured in three folders. CARBORUNDUM COMPANY. Pages 138-139.

**76** **Flexible shaft equipment** for weld grinding and finishing is featured in Catalog C-210G. FRANKLIN BALMAR CORP. Page 140.

**78** **Chrome-moly electrodes** which require minimum of preheat and stress-relief are introduced. METAL & THERMIT CORP. Page 143.

**80** **Distributor list** tells where to purchase complete line of low-temperature silver brazing alloys. HANDY & HARMAN. Page 147.

**81** **Balanced-pressure regulators** with many new features are introduced. LIQUID CARBONIC CORP. Page 149.

**82** **Hard facing manual** gives information on complete line of hard facing alloys and how they can be used to prevent wear. WALL COLMONOY CORP. Page 151.

**83** **Combination welding helmet-safety cap** is introduced in bulletin. WILLSON PRODUCTS, INC. Page 152.

**84** **Industrial arc welders** for every application are included in illustrated literature. TRINDL PRODUCTS, LTD. Page 153.

**85** **How to remove welding fumes** at their source is subject of Bulletin 37-E. RUEMELIN MFG. CO. Page 154.

**86** **Brazing data book** features complete line of silver-brazing alloys and fluxes. GOLDSMITH BROS. SMELTING & REFG. CO. Page 155.

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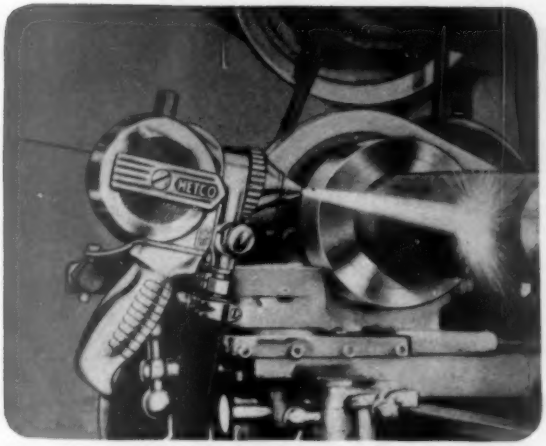


# now a really low-cost metallizing installation...

## with the new Metco L-Gun

**New, low, compressed-air requirements . . . only 10 cfm at 40 to 60 psi, already available in many shops, or supplied by inexpensive 3 hp compressor . . . bring metallizing within reach of the small user.**

*Metallizing damaged journals on turbine shaft*

*Building up worn brake-drum*

*Metallizing protective coating on steel plate*

Here's a chance for the smaller maintenance shop to get into profitable metallizing operations like these:

- Save up to 90% of replacement costs on machine repair jobs,
- Do your own hard-facing,
- Apply long-wearing corrosion-resistant coatings to exterior plant structures, tanks and other equipment.

**Sprays 23 Different Metallizing Wires**—With the new L-Gun you can spray .10, .25, .80 carbon steels, stainless; babbitts, brass, bronze; nickel, aluminum, tin, zinc; special hard-facing materials such as Metco-Weld H, and the new self-bonding Spraboad wire.

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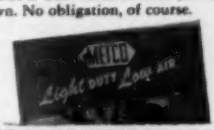
**Same High Quality as Other Metco Guns**—The low air requirements of the new L-Gun have been achieved without any sacrifice in Metco quality. It embodies new developments in turbine and nozzle construction—is built, like all Metco guns, for rugged, dependable service.

**A Real Opportunity for the Smaller Shop**—Thousands of large, well-known companies have been metallizing users for many years, not only in maintenance but in production applications on original equipment. Now, with the development of the new L-Gun, and a low cost installation, metallizing is within the reach of even the smallest plant. (We'll be glad to send you the names of some Metco users—large and small.)

**Free Bulletin or Shop Demonstration**—Send off the coupon for the detailed information Bulletin 55 gives you. Or, better still, ask for a demonstration in your own shop by a Metco Field Engineer. He'll be glad to show you how the new Metco L-Gun works on some job of your own. No obligation, of course.




See other examples of metallizing illustrated in our 8-page Bulletin in your Sweet's Plant Engineering File—Section 7a/Me.

The following names are the property of Metallizing Engineering Co., Inc.: Spraboad Wire, Metco-Weld, Metco*. *Reg. U.S. Pat. Off.

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METALLIZING ENGINEERING CO., INC.
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☐ Please send me more information about metallizing.
☐ Please arrange a demonstration in my shop.

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**Circle No. 29 on Reader Service Card.**

## ARCAIR TORCH cuts assembly time 20% in fabricating large steel tanks

A NEW time and money saving procedure for tank fabrication has been developed in the Seattle, Washington shops of the Olympic Welding Co., based on the use of the Arcair torch.

In this procedure steel plates are set up for welding, square-butted against one another. A light sealing pass is made on the *inside* of the seam, enough to hold the plates in correct alignment, and the outside seam is left *untouched*. The welder then makes one pass with the Arcair torch, to gouge out the outside seam, which leaves an even, clean groove ready for welding, which was then filled with two passes to give a 100% weld.

The shop foreman at Olympic reports that this new fabrication method has been saving up to 20% in assembly time, by eliminating beveling of plates before fit-up and preparing both sides of the groove simultaneously.

Write TODAY for free bulletin showing facts and figures of time and money-saving applications using the Arcair torch.

**ARCAIR COMPANY**
**429 South Mt. Pleasant Ave.**
**Lancaster, Ohio**

**Circle No. 30 on Reader Service Card.**

**89** **Repair shapes and welding rods** for welding manganese steel are described in Bulletin 451. TAYLOR-WHARTON IRON & STEEL CO. Page 157.

**91** **Vise-type pliers** which unlock at flick of a finger are featured. H. R. BASFORD CO. Page 158.

**92** **New electrode holder** with new features and in complete range of sizes is introduced. H. J. WAGNER PRODUCTS, INC. Page 158.

**94** **Electrode holders** which minimize stud waste are described in Form SS-3. BERNARD WELDING EQUIPMENT CO. Page 159.

**95** **Hard facing alloys** made of cobalt-chromium-tungsten are featured in bulletin. CROBALT, INC. Page 160.

**100** **Welding hose reels** with various capacities are featured in catalog. UNITED SPECIALTY CORP. Page 162.

**103** **Application data** explains how to use welding fume exhausters. ENGWALD CORP. Page 163.

**112** **Heavy duty toggle clamps** are featured in free literature. APEX WELDING & FABRICATING CORP. Page 165.

**114** **Fluxes for every welding,** brazing and soldering application are included in latest bulletin. KREMBS & CO. Page 167.

**115** **Spatter-proofed clamps** with many improved features are described in catalog. GRAND SPECIALTIES CO. Page 167.



**Circle No. 31 on Reader Service Card.**→

# HARRIS 1905 — 50TH — 1955 ANNIVERSARY

"Fifty years of Achievement". We say this proudly-but are humble in our thanks to our thousands of users, our distributors and to our employees, present and past, who have enabled us to become the oldest company in this country devoting all our interests to the manufacture of Gas Welding and Cutting Apparatus.

Our many "firsts" have blazed an envious trail and have inspired us to develop even more unusual "firsts" which will be presented in the future to the Industrial World.

## THE HARRIS CALORIFIC COMPANY
### CLEVELAND 2, OHIO

# Here Are the NEW

## MID-STATES *Viking* Heavy Duty Industrial AC and DC ARC WELDERS

Mid-States Viking Inert Gas AC Welder 200-300 rated amps, 230-460 volts.

Mid-States Viking DC Welder 200-thru-400 rated amps, 230-460 volts.

Mid-States Viking AC Welder 200-thru-500 rated amps, 230-460 v.

**Select from the Complete MID-STATES Line**

Something new and big has been added to the Mid-States Welder line: the New Mid-States Viking AC and DC industrial-duty arc welders . . . proved in performance and recognized for their fine quality.

Mid-States Viking Welders are available in three types to suit every industrial welding purpose:

AC transformer type of 200, 300, 400 and 500 amps rated capacity; DC rectifier type of 200, 300 and 400 amps rated capacity; and the AC inert gas type of 200 and 300 amps rated capacity. The Mid-States Vikings have patented features, unique design and a sturdy construction.

And in the well known Mid-States Welder group of lower amperage units there are sizes ideal for shop use—ranging from 7 to 300 amps capacity. Whatever your arc welding problems may be, light or heavy duty, general or production work, there is a Mid-States to do the job the way you want it done.

Write for literature and details today!

Mid-States 210 AC Welder with No. 10 Missing Link 200 amps, 230 volts.

Mid-States 175 Bulldog 180 amps, 230 volts.

*Dealers invited—some good territories open—write for details.*

**Mid-States WELDER MFG. CO.**

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# Do every grinding job with the "TOUCH of GOLD"

***The Norton line of weld grinding wheels is 100% complete . . . 100% top-performing***

***Norton Straight Wheel*** makes fast work of smoothing a heavy butt weld. This is a resinoid bonded wheel, made of Norton ALUNDUM® abrasive, the toughest, strongest abrasive you can use.

***Norton Flaring Cup Wheel*** grinds a weld on a fabricated structure with minimum effort on the operator's part (Note rotating guard). Built-in balance makes all Norton portable wheels *hug that work*.

***Norton Cone Wheel*** smooths up a hard-to-get-at weld on a fabricated machine base. Easier handling on countless jobs like this means faster, more profitable work for *you*.

**Circle No. 34 on Reader Service Card.**

From your lightest scale removal to heaviest duty cutting-away there's a type and size of Norton wheel that will do the job faster, for less money, and produce better results.

Norton portable wheels include all standard solid types, as well as the increasingly popular reinforced types, especially engineered for maximum strength, safety and versatility. They're built to *hug that work,* with more continuous contact, less vibration and bounce. Which means less operator fatigue and more metal ground off per man-hour — additional "Touch of Gold" advantages that boost your profits!

*Your Norton Distributor* will gladly help you select the right wheels from this complete line. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your classified phone directory. Behr-Manning Corporation, Troy, N. Y., is a division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

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***Norton BFR Semi-Flexible Hub-Type Wheel*** smooths a welded radius. Strong, safe and versatile like all Norton Reinforced Wheels, the BFR is best for lighter weld grinding applications. Like the BD it notches, slots and cuts off.

***Norton BF Semi-Flexible Wheel*** blends a contour on a stainless steel part for a piece of pharmaceutical equipment — a material for which this lightest Norton Reinforced Wheel is especially suitable.

W-1564

***Norton BD Rigid Hub-Type Wheel*** smooths a flame-cut edge. This heavy-duty Norton Reinforced Wheel is also excellent for cutting-away, smoothing heavier welds, making V-cuts for removing old weld material, etc.

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ABRASIVES

*Making better products . . . to make other products better*

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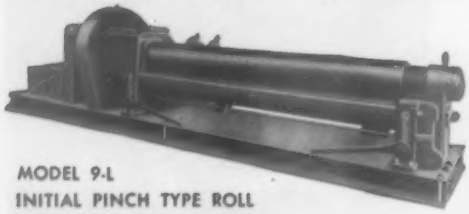
# WEBB PLATE FABRICATING MACHINERY

## PLATE BENDING ROLLS



MODEL 9-L
INITIAL PINCH TYPE ROLL

Two types available: the Initial Pinch Type and Pyramid Type machines. All latest advantages of today's modern machine tools are incorporated, utilizing anti-friction bearings, totally enclosed gear drives. Special forming rolls for culvert pipe, stock tanks and other special shapes available.

### SLIP ROLLS

A complete line of small Sheet Metal Forming Rolls are also available. All power-driven with shaft sizes 3" to 5" for the handling of the thinnest gauge material, up to 8 gauge material. Special rolls for the forming of polished sheets, aluminum and stainless steels can be furnished. Complete catalogues on any size machine furnished upon request; write Dept. C.

SLIP ROLLS
UP TO 8 GAUGE PLATE

The Webb Corporation offers a complete line of Plate Bending Rolls for the rolling of the thinnest plate up to plate 2½" thick. Offered in a variety of lengths and thicknesses. Constructed for the modern fabricating shop.

***Let Speed PAY-The WEBB Way!***

SLIP ROLLS

PYRAMID TYPE ROLL

INITIAL TYPE ROLL

STEELWORKERS

Also Manufacturers of INDUSTRIAL WEIGHING EQUIPMENT

*Since 1881* THE WEBB® CORP.
WEBB CITY, MO., U. S. A.

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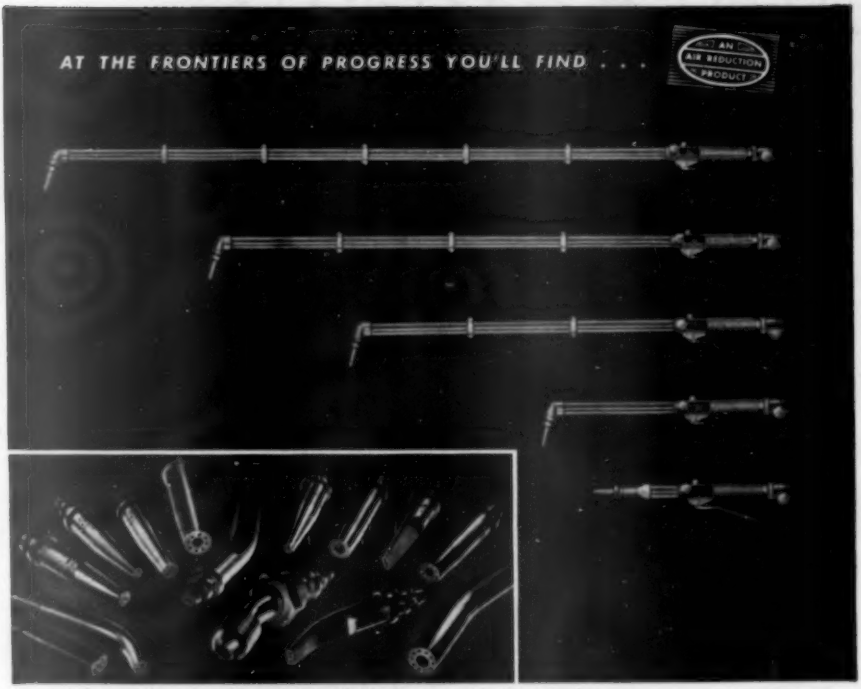


Inset: A few of the many Airco tips available for use with Airco torches.

# *Airco Cutting torches*... from 13 inches to 6 feet in length!

The Airco 9000 series hand cutting torches are designed to make short work of jobs in scrap cutting, rivet washing and general maintenance.

Here's flexibility at its finest. Torches range from the 13-inch length for working in confined areas to the 72-inch length for keeping heat and fumes at a distance and include the standard 21-inch model. Torch heads are available with 45°, 75°, 90° and straight heads — your choice of monel or bronze.

An extremely wide selection of cutting tips, (over 25), makes them adaptable for cutting metal thicknesses from sheet metal up to 12″ steel. Tips are available for cutting with acetylene, propane, or natural gas.

Companion accessories include the Airco Flash Circle Burner which is adjustable to cut circles 2½″ to 17″ in diameter. This unit can also be used with all cutting attachments and machine cutting torches.

See your Airco representative or Authorized Airco Dealer for detailed information and assistance — or — write Airco direct. Request Catalog 818.

AIRCO®

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*Divisions of Air Reduction Company, Incorporated, with offices and dealers in most principal cities*

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Represented Internationally by

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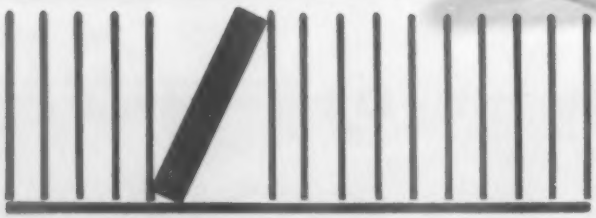

# useful free literature

**The publications featured on these pages were written by experts. They are FREE to our readers. To obtain these helpful reference materials use the postcard bound into this issue.**

**GAS WELDING AND CUTTING** needs and how to fill them is the subject of a 36 page brochure prepared by Modern Engineering Co. A full line of equipment ranging from torches to regulator wrenches is pictured and described. **Circle No. 125 on Reader Service Card.**

**STUD WELDING** applications is subject of pamphlet giving detailed procedures and complete information on standard types of studs and stud welding equipment. Issued by Nelson Stud Welding Div., Gregory Industries, Inc. **Circle No. 126.**

**HARD SURFACING WELDING MATERIALS** made by Rankin Mfg. Company are the subject of colorful, illustrated 8-page brochure. Complete line of alloys for application by arc welding or oxy-acetylene flame are listed and typical applications shown. Complete operating instructions, including amperage and polarity, are given. **Circle No. 127 on Reader Service Card.**

**PORTABLE RESINOID SNAGGING WHEELS,** which are said to offer speed, long service and low cost, are featured in colorful 4-page brochure from Allison Company. Complete specifications and operating characteristics are given for use of straight and cup-type wheels on various metals. **Circle No. 128.**

**OXY-ACETYLENE WELDING EQUIPMENT AND ACCESSORIES** are featured in Catalog No. 355 issued by Smith Welding Equipment Co. Described and illustrated in the comprehensive 24-page booklet is the company's complete line of torches and equipment for welding, cutting, heating, brazing and soldering. Complete specifications are given to make ordering easy. Operation instructions are included. **Circle No. 129 on Reader Service Card.**

**PRECISION MADE GAS CYLINDERS** for oxygen, acetylene, nitrous oxide and other medical gases are featured in illustrated cylinder specification sheet issued by Norris-Thermador Corp. Material should be of special interest to gas manufacturers and distributors of welding and cutting gases. **Circle No. 130.**

**MAGNETIC AMPLIFIER RECTIFIER WELDERS** with many exclusive patented features are described and illustrated in a colorful new brochure offered by Vickers Electric Division. Advantages of full time automatic arc control, full range voltage control and other engineered features of the new selenium rectifier welder are graphically illustrated. **Circle No. 7.**

**EYE PROTECTIVE EQUIPMENT** for welding and grinding operations is featured in 12-page Bulletin 100 RR available from Watchemoket Optical Co. Actually a catalog, the bulletin illustrates and describes in detail a complete line of face shields, goggles and safety glasses. New "Stac-Vent" ventilation which eliminates fogging is explained in detail. **Circle No. 131.**

**TINNING AND SOLDERING COMPOUNDS** which clean and tin metals in a single, easy operation are featured in colorful data sheet from Tinit Mfg. Co., Inc. The data sheet explains in detail what the compounds are, what they do and how to use them on all types of tinning and soldering operations. **Circle No. 132 on Reader Service Card.**



**Circle No. 37 on Reader Service Card.** →

CADDY Type B-400 Amp. ELECTRODE HOLDER in use on CATERPILLAR production line—Peoria Plant.

**CATERPILLAR**

Today in its 51st year, the track-type tractor can look back over an outstanding record of accomplishment and development. Rugged crawlers of 1955, like this Caterpillar D8 Tractor working on a highway construction job in Missouri, are bigger, better and busier than ever.

**uses**

**CADDY® ARC WELDING ACCESSORIES**

Caterpillar Tractor Co., internationally famous manufacturer of road building machinery for over 50 years, constantly strives for more efficient, lower cost production methods in all of their manufacturing operations.

Since 1951, arc welding circuits have been closely studied at Caterpillar under the direction of Mr. Donald L. Caldwell, Welding Supervisor, in an effort to increase efficiency and lower maintenance costs. His studies have resulted in a more efficient operation and a substantial monthly saving for Caterpillar Tractor Co. This saving can be largely attributed to the use of CADDY ARC WELDING ACCESSORIES and CADWELD solid-copper cable splices.

Overall circuit maintenance has been materially reduced, electrical efficiency increased, and according to Mr. Caldwell, operators find CADDY holders lighter-weight and cooler-operating than former holders used.

**CADDY® Arc Welding Accessory Div.**

**Erico Products, Inc.**

2070 E. 61st Place • Cleveland 3, Ohio

IN CANADA: ERICO INCORPORATED, 3571 Dundas St., West, Toronto 9, Ontario

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**SOLDERING FLUXES FOR USE ON ALL METALS** are subject of 8-page brochure and data sheet offered by Lake Chemical Co. Described are five types of stick, paste and liquid fluxes for use in a variety of applications and on a variety of metals, including stainless steel. **Circle No. 133 on Reader Service Card.**

**TANK-MOUNTED SINGLE STAGE AIR COMPRESSORS** made by Worthington Corp. are the subject of a complete new catalog. Sizes, ratings and standard features are given for 80, 100 and 150 lb. units. Complete operating instructions are given in 4-page brochure. **Circle No. 134 on Reader Service Card.**

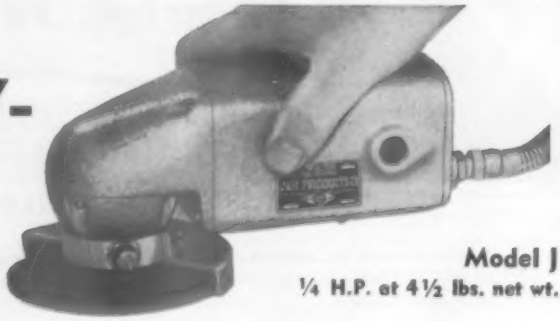
**A COMPLETE NEW LINE OF GAS REGULATORS** is introduced in Catalog 55 offered by Oxo Welding Equipment Co. Complete and colorful 12-page brochure gives specifications for the company's line of single and two-stage regulators and flowmeters. Explained in detail are special features, including patented single unit nozzle and protective guard. **Circle No. 135.**

**WELD GRINDING AND FINISHING** with a new abrasive wheel is featured in a colorful data sheet offered by C. R. Vogt and Co. Explained in detail is the All-Four abrasive wheel designed for grinding, sanding, polishing and deburring. Wheel is described as being neoprene rubber bonded to a cast aluminum wheel to give a live rubber base which prevents slippage and serves as a cushion under abrasive cloth used. **Circle No. 136 on Reader Service Card.**

**EVERYTHING BRASS AND BRONZE** is featured in 20-page pocket-size booklet which describes all brass rod mill products made by Titan Metal Mfg. Co. Weight tables, specifications and other technical data are listed in handy form on Titan free-cutting brass, commercial bronze, Ti-nic-o-sil, Tombasil, forging rods and shapes, brass wire and boat shafting. **Circle No. 137.**

*(Turn to Page 50)*


# A MIGHTY-MITE OF A GRINDER



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**Same quality-engineered features as large models. Drives 4" hub wheel so average man can't stall with one hand. Not a toy but a real production grinder for hard-to-get-at places.**

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**J & H PRODUCTS COMPANY**
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## and would you like to grow into a big one more rapidly? ● ● ●

If you consider yourself a growing, aggressive, ambitious distributor in the welding industry, our old established company has a great deal to offer you.

We have been in the welding and the welding equipment business for over 44 years. We believe that those who have sold or purchased NATIONAL welding and cutting torches, regulators, cylinder manifolds and all of the other items we produce, found them good. Found them, beyond doubt, the VERY FINEST money may purchase.

And, what is more important from your point of view, this apparatus is so carefully designed and so well built, that neither you nor your customer will need to spend costly time and vexing hours on frequent repair service and undesirable "shut downs". And, neither you nor your customer will need to invest as heavily in repair parts and in innumerable varieties of models and types. Yet . . . our line is as versatile, as complete, as all-embracing as is any other. But . . . we have taken great care to do our own experimenting rather than impose this thankless and costly task upon our distributors and their precious customers.

We have very much to offer, both to you and to your prospects and customers, and we most cordially invite you to communicate with us BEFORE YOUR TERRITORY WILL BE SPOKEN FOR.

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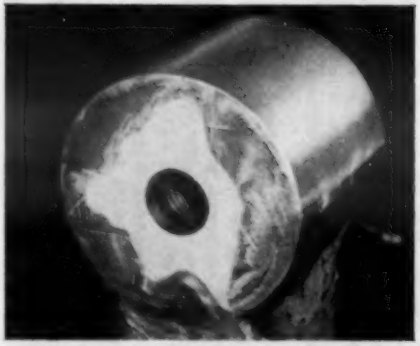
Circle No. 40 on Reader Service Card.

**THREE DIFFERENT BREAKS** in two years. Each would have normally condemned this costly equipment to the scrap heap.

# This 5-ton cast-iron column of a drop-forge hammer was braze-welded with Anaconda Tobin Bronze Rod

"We've done many jobs of this type," says Wilson E. Campbell, Sr., President of Industrial Welding & Brazing, Inc., Lansing, Michigan, "but repairing this 10,000-lb. column casting for a drop hammer was as tough as any. Yet we fixed it up not once but three times



**REBUILT INSIDE AND OUT** with Tobin Bronze. Large punch press connection was bored for the bearing and ground off outside.

—in three *different* places—each time as good as new.

"Last year," Mr. Campbell continues, "we repaired over a thousand different parts for *one* large auto maker. We did most of this work with Tobin Bronze—our favorite welding rod for over 30 years."

Why does Industrial Welding like braze-welding for repair work? It's economical and dependable, and needs less preheating. High stresses don't build up, and there is less danger of cracking.

Why Tobin Bronze* Welding Rod? Mr. Campbell reports: "Tobin Bronze Welding Rod flows freely—'tins' fast—bonds strong and sound. It's good for a wide variety of repair welds—engine blocks, cast-iron pipe, machinery parts and other equipment."

Purity Cylinder Gases, Inc., with headquarters at Grand Rapids and branches in western Michigan and northern Indiana, supplies Industrial Welding with all their rods. Like Purity, there are Anaconda distributors throughout the United States ready to help you with your welding problems—and to serve you with the Anaconda Welding Rod best suited to your particular repair and production job. *The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.*

*Reg. U. S. Pat. Off. 54139

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**WELDING RODS**

*Anaconda Copper-372 • Tobin Bronze-481 • Anaconda-997 (Low Fuming) Bronze • Nickel Silver-828 • Cupro Nickel-826 • Everdur-1010 • Ambraloy-928 • Phosphor Bronze-351 • Phosphor Bronze-354*

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**TEMPERATURE INDICATING PRODUCTS** for every welding and industrial application are featured in colorful data sheet from Tempil Corp. Brochure contains concise directions for choice and use of temperature indicating pellets, paints and sticks. Newly developed items in 400° to 500°F interval are introduced. **Circle No. 64 on Reader Service Card.**

**BENDING BLOCK AND WELDING PLATENS** for welding, bending, layout work and assembling are described in detail in illustrated 4-page brochure offered by Acorn Iron & Supply Co. How warpage of welded members is kept to a minimum and eliminated is described. Government facilities and industrial firms who use these blocks are listed. **Circle No. 105.**

**WELDING MATERIALS SPECIFICATION BOOK** available from Shieldalloy Corp. gives chemical and screen analyses for power metals and alloys, processed minerals and ores, and chemical analyses of metals and alloys. Primarily prepared for the welding electrode manufacturing industry, the two-color, 37-page book describes chromium metal, titanium-aluminum master alloy, powdered ferro-alloys and melting base alloy, processed fluorspar, rutile and zircon. **Circle No. 140 on Reader Service Card.**

**BRONZE ELECTRODE COMPARISON CHART** prepared by Ampco Metal, Inc., to help in correct bronze electrode selection lists all known brands of aluminum bronze, phosphor bronze, nickel-aluminum and manganese bronze electrodes on the market. **Circle No. 141 on Reader Service Card.**

**WORK HOLDING EQUIPMENT FOR WELDING** and jig and fixture components are featured in a new 64-page catalog from Jergens Tool Specialty Co. Profusely illustrated catalog features complete engineering data on thousands of "in-stock" sizes of chuck jaw blocks, work holding clamps, handles, knobs, wheels, etc. A simple ordering system included eliminates ordering errors. **Circle No. 142 on Reader Service Card.**


SPA-FLA GIVES YOU *Portable* PROTECTION!

FROM ARC-FLASH-SPARK!

**A PORTABLE SAFETY WELDING SHIELD FOR COMPLETE PROTECTION** confines harmful welding flash for personnel protection, and safeguards your property from sparks, torches, salamanders, hot chips, or abrasive particles. Stands solidly formed in any position desired. With the addition of sturdy "On the Ring" Stands, the SPA-FLA Shield is an excellent wind breaker and protector for outside use. Material is 15 ounce fire resistant yellow canvas—completely Underwriters Laboratories Approved.

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Easy to store. Corner re-inforced D-rings, standard SPA-FLA equipment, provide easy hanging on overhead welding jobs. Easily carried from job to job . . .

SPA-FLA Shields are available in stock sizes, 18" x 36" through 72" x 108"! Special sizes on request.

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*VICTOR Quality Cutting Torches will do a better job and stay on it under all kinds of difficult cutting operations.*

VICTOR for welding

**VICTOR EQUIPMENT COMPANY**

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**ONE OF THE LARGEST WELDING CATALOGS** ever compiled is the way in which Burdett Oxygen Co. describes its new Catalog H. Comprising 84 colorful pages, the catalog describes and illustrates latest types of equipment and supplies for both oxy-acetylene and arc welding. An entire section is devoted to industrial safety equipment. **Circle No. 10 on Reader Service Card.**

**LOW TEMPERATURE WELDING** is explained in a new 32 page "DirectoRod Guide" issued by Eutectic Welding Alloys Corp. Over 300 low heat input metal joining applications and procedures are described in the two color book. Explained and illustrated are procedures for welding and overlay, welding cast iron and joining "difficult" metals. **Circle No. 54.**

**TOOLING FOR AUTOMATIC WELDING** is featured in new, enlarged 40-page catalog offered by Cecil C. Peck Co. Examples are given of special purpose automatic welding machinery for submerged and inert arc welding. Standard and special tooling, fixtures and machinery are described in detail. **Circle No. 145.**

**WELDING SUPPLIES AND ACCESSORIES** are listed in a new 36-page catalog covering the complete arc welding and oxy-acetylene welding line made by Air Reduction Sales Co. Described and illustrated in form ADC 848 are welding electrodes and holders, welding rods, brazing alloys and fluxes, protective clothing and safety equipment, and various supplies and accessories. **Circle No. 146 on Reader Service Card.**

**"WELDING OF STAINLESS STEEL"** is the title of a complete "how-to-do-it" 48-page handbook offered by McKay Company. Fact-filled brochure describes various types and properties, practical procedures for their welding and types of electrodes available for such use. Material is presented in easy-to-follow question and answer form. **Circle No. 147 on Reader Service Card.**

VELOCITY-POWER stud units give you approved holding power for pipe hanging jobs

Both Underwriters' Laboratories and Factory Mutual have approved V-P ¼-in. threaded stud units for hanging pipe up to and including 5-in. diameter.

Get complete facts on this *approved* holding power, and other Velocity-Power features. Write for details on this modern production tool.

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# HOW TO BUY ABRASIVE WHEELS

## for Longer Life

## on Tough Finishing Jobs

### *"More Use per Dollar"*

Look for a *molded* disc wheel, specially bonded for your job conditions . . . to insure free, uniform cutting action down to the last usable part of the wheel.

For roughing and finishing operations on weldments, castings and forgings, molded disc wheels last much longer than ordinary coated abrasive discs. New and sharp abrasive grits are exposed continuously to give clean, fast cutting action . . . the disc does not become dull or loaded. Operator time for wheel changes minimized. Where the molded disc is reinforced with special super-strength fabric and held together with shock-resistant bonds, safety is increased. You get a better finish, faster . . . and save production time and costs.

Specify, by name, the molded disc wheels custom-made for longer, trouble-free service on your roughing and finishing jobs . . . specify Manhattan Moldiscs.

## MANHATTAN MOLDISCS

Tests have proved that Manhattan Moldiscs outlast as many as 25 to 30 ordinary coated abrasive discs on many jobs. Every Manhattan Moldisc is custom-made with the rubber or resinoid bond to best suit your application . . . for smoothing welds, beveling edges, removing burrs and fins on mild steels, stainless alloys, aluminum and copper.

Special super-strength fabric reinforcement prevents breakage on the job. Special molded abrasive presents a fresh cutting surface throughout the wheel thickness. Manhattan Moldiscs are bonded in various grades from fast roughing to fine finishing. Let a Manhattan representative demonstrate how you get "More Use per Dollar" . . . with Manhattan Moldiscs and other types of Manhattan high speed, heavy duty abrasive wheels.

RM-526 **WRITE TO ABRASIVE WHEEL DEPARTMENT**

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

**RAYBESTOS-MANHATTAN, INC.**

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose Fan Belts • Brake Linings & Blocks • Clutch Facings • Packings • Asbestos Textiles Engineered Plastic, and Sintered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

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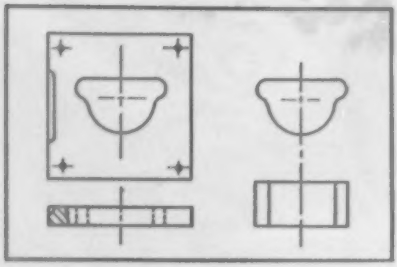
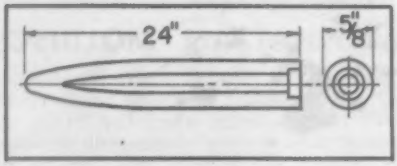
## Solutions To 4 Typical Hardfacing Problems



**When worn, these flash trimming dies were faced with alloy containing 60 percent cobalt, 30 percent chromium, 5 percent tungsten, 2 percent molybdenum and 1 percent carbon. Parts were preheated to 400°F before welding, but no subsequent heat treatment was required.**




**Entire exterior surface of this hot work draw punch was faced with alloy containing 45 percent nickel, 17 molybdenum, 16 chromium and 4 tungsten. Part was preheated to 300°F and overlay made with inert gas shielded metallic arc welding.**

# How to Choose Hard Surfacing Alloys

by **GEORGE H. THURSTON**

THERE are four main groups of hardfacing materials.

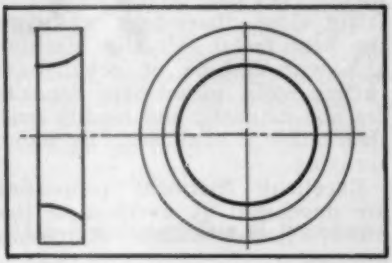
Group 1 includes ferrous base metal with less than 20 percent alloying elements. Group characteristics are: low cost, high hardness and moderate toughness. Generally applied best by metallic arc welding, the metals are usually magnetic as deposited.

Alloys used are in three forms. One is with alloying elements in the coating over a carbon steel wire. This is not efficient except for low alloy grades. Another is to alloy the metal in the melting furnace and cast into rods, which may or may not be coated. This second method is usually restricted to the higher alloy ranges.

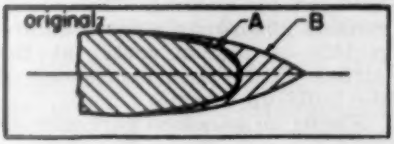
The third way is to fabricate a mild steel tube with ferro alloys inside. This method has marked cost advantages in the upper range of alloy content.

Practically any tool steel can be matched by a rod of Group I having similar hardening characteristics. However, a good welding operator can do a wide variety of tool and die rebuilding jobs with one grade of tool steel; an air-hardening 5 percent chromium, for example.

Group II is made up of ferrous base metal with alloy content from 20 to 50 percent. These include manganese, silicon, chromium, mo-



**Made of 5 percent chromium-low carbon hot work steel, this hot draw ring had an original hardness of 50 RockwellC. Automatic inert arc welding was used to face working surface with alloy containing 45 percent nickel, 17 percent molybdenum, 16 percent chromium and 4 percent tungsten.**




**Manganese steel bucket tooth was first given layer of Type 309 stainless (A) because work hardened layer was not ground off. Build up (B) was made with manganese steel containing nickel and molybdenum. D-C reverse polarity, skip welding and peening while hot were used.**

lybdenum, tungsten, vanadium, zirconium, cobalt, boron or nickel. Group characteristics are higher cost, more wear resistance and less toughness than Group I. They are almost always cast to rod shape—although one of the best is tubular—and are applied by arc or oxy-acetylene welding. Most rods of this group are magnetic as deposited.

The austenitic metals of this group are often used because they are machinable as deposited, the others are not. Chromium carbide is the principal hard constituent and chrome content is usually over 25 percent.

## Non-Ferrous Alloys

In Group III are found all non-ferrous hard surfacing metals. These have lower melting points than the steel bases to which they are usually applied. They show far greater wear resistance than ferrous materials of similar hardness, exhibit great corrosion resistance in many environments and their superiority is more pronounced at high temperature than at room temperature.

## Advantages of Cobalt

Cobalt-base metals are quite expensive and are applied by gas, arc or inert arc welding. They require no heat treatment. Deposits are machinable with carbide tools, and usually give best wear resistance when service temperature is elevated and reasonably steady.

Many of the nickel base metals are rather soft as deposited. Their room temperature wear resistance does not equal that of the hard ferrous metals and their high temperature abrasion properties do not equal the cobalt-base types.

These deposits, however, are very

resistant to spalling and heat checking when temperatures fluctuate. They can be hot formed to fairly close dimensions while on the base metal. Usually machinable with carbide or cobalt-base cutting tools, nickel-base deposits are non-magnetic and readily lend themselves to application by flame spraying.

Excellent frictional properties are developed by overlays of the hard, heat-treatable aluminum bronzes.

### Use Diamond Substitutes

So-called diamond substitutes of Group IV are very hard metallic compounds. Tungsten carbide is the most widely used, usually in cast form.

Very thin overlays of tungsten carbide can be applied by flame spraying. These overlays are used in parts subjected to extreme abrasion without much impact, principally where fine finish and accurate dimensions are not required. These are finished only by grinding with silicon carbide followed by diamond for best finish.

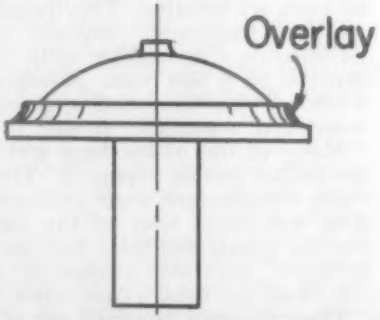
The cermets (for example, chromium plus aluminum oxide) are used for hardfacing and resemble some Group IV materials. The cermets actually resemble sintered carbides rather than cast.

Each hardfacing application is a special problem: the geometry of parts, internal stress patterns and service conditions may change any general recommendations. In general, one can assume that any metal which can be "sweat" can be surfaced by welding. "Sweating" consists of forming a very shallow puddle of molten metal at the surface of the base part ahead of the build-up action.

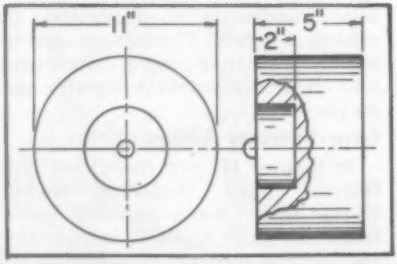
Facing an annealed part with no

## 4 More Applications For Hardsurfacing

**This hardfaced valve outlasted original by about 10 times. Ferrous base alloy with 48 alloy in steel tube was applied to carburized alloy steel base metal with metallic arc welding. Part was preheated to 1100°F, but no postheat was required.**




**Shock-resistant tool steel retainer ring contains 0.55 percent carbon, 2.0 percent silicon and 0.5 molybdenum and has hardness of 42 RockwellC. Insert was air-hardened tool steel containing 1.0 percent carbon, 5.0 percent chromium and 1.0 molybdenum. Hardness is 55 RockwellC.**



restrictions on preheat or postheat is one problem which has considerable latitude in solving. The repair, without tempering, of use-hardened dies which are worn, broken or require a change in design, require expert welding. In the first case, the part will usually be heat treated after welding.

Again generalizing, the heat treating properties and the coefficient of expansion of the filler rod should match those of the base metal. It is not necessary that the chemical composition match, but if it is desired to match the analysis, several methods can be used to deposit alloy and tool steels without significant change.

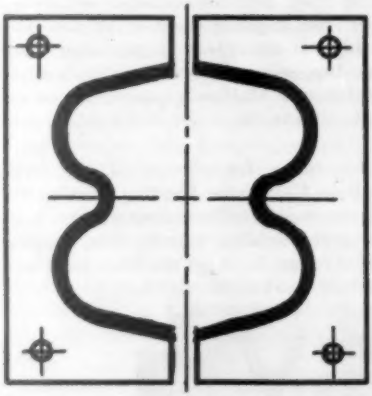
## Weld Annealed Parts

The rule that parts to be hardened and parts to be welded should be in the annealed state apply to this procedure. If the base need not be hardened, then a self-hardening filler rod would give the proper qualities as the working locations. Complex shapes and restraint of welds call for higher preheat, slower cooling and more stress relief. The importance of the temperature of the work before and during welding is often overlooked by many.

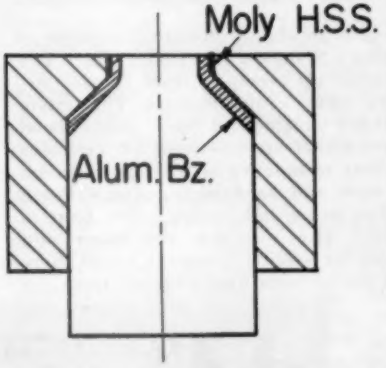
## Use-Hardened Die is Problem

When a use-hardened tool steel die must be rebuilt without warping and without re-heat treating, the operator has a real problem. The die is quite likely to have many small, unimportant cracks which will not shorten useful life. They need not cause breakage in welding unless they cross stress lines or lie in the region of the weld. The operator should learn

*(Continued on Page 140)*



**Blanking die or air-hardening tool steel was rebuilt with 1 percent carbon, 5 chromium, 1 molybdenum and 0.75 percent steel. Method: preheat to 600° F, oxy-acetylene weld peened after each pass, slowly cooled to 150°F, tempered at 450°F.**




**Two mating parts of oil-hardened die steel were overlayed. High speed steel overlay on block contained 0.80 percent carbon, 8.0 molybdenum, 4.0 chromium and 2.0 vanadium. Aluminum bronze overlay on spinner contained 80.0 percent copper, 10 percent aluminum, 5 nickel and 5 iron.**

# Hundreds of "*Special*" Electrodes

## are Standard MALLORY Designs . . .

## *And Cost Less!*

Just about any resistance welding electrode you may require . . . straight, bent, long, short, irregular . . . you can find in the extensive family of Mallory designs.

There is an almost unlimited selection of Mallory Standard Electrodes which can be made up promptly from existing designs, using available tools. This group includes single-bend and double-bend types which are produced by exclusive Mallory techniques to develop maximum strength and hardness . . . with fluted cooling holes and cooling tubes bent in place.* Also available are many odd shapes for welding in corners, inside channels and in other hard-to-reach spots.

Chances are you can get electrodes from Mallory which fit your application exactly . . . with prompt delivery . . . at a price that provides substantial savings over custom-made designs. All are made to highest standards of precision workmanship, using alloys and methods developed during Mallory's quarter century of leadership in the resistance welding field.

Write today for a copy of the latest Mallory Resistance Welding Catalog listing the complete line of electrodes, holders, seam welding wheels, dies, forgings and castings . . . or get one from your local Mallory welding distributor.

P.R. MALLORY & CO. Inc.

MALLORY

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

*Patent No. 2,489,993

**For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio**

**Circle No. 45 on Reader Service Card.**

# $CO_2$
## Carbon Dioxide

# Will It Replace Argon And Helium For Inert Arc Welding?

ONE of the industry's most important recent developments, yet one of the most controversial, is the use of CO-2 as a shielding gas for inert-arc welding.

Much has been written, pro and con, about the remarkable cost savings that can be affected through use of this gas. Some statements attributed to manufacturers who have been investigating the process, have been vehemently denied. Even the most enthusiastic exponents of the new process have hesitated to make specific comments concerning its overall efficiency. Yet most welding people agree that properly developed, the process could revolutionize methods of inert-arc welding.

Because of the relatively high cost of argon and helium, and, in some cases because it is not always readily available, some manufacturers have been searching for a satisfactory substitute. Others have developed equipment which reduces cost of inert-arc welding by reducing the consumption of argon. One such process, developed by Westinghouse, has been very successful. Another, the Bernard-arc, utilizing both argon and an inexpensive granular flux, has also been able to produce satisfactory welds at lower argon costs. Yet neither of these has been able to come close to the savings suggested by several producers of CO-2 and of new equipment with which it can be used.

### Cost Comparisons

Among the advantages claimed for CO-2 as a shielding medium, the primary one is its low cost. Averaging approximately one cent per cubic foot in cylinders, this cost is compared with eight cents per cubic foot for argon and six cents per cubic foot for helium. In addition, it is estimated that only half as much CO-2 need be used. One manufacturer has calculated that the dollar savings over a period of one year, operating automatic equipment, on three shifts, amounts to $13,000!

According to A. O. Smith Corporation, one of the first companies to announce availability of equipment for the process, there are still certain limitations to consider. Apparently successful in welding carbon steel, C-Omatic, the A. O. Smith process, is now being carefully studied to develop its potential for welding other steels and alloys.

**Possibilities not yet fully explored**

This process is currently confined to single pass, flat position welding. Although tests indicate that multi-pass welding could be done, further investigation is being conducted to determine procedures which will produce consistently sound welds.

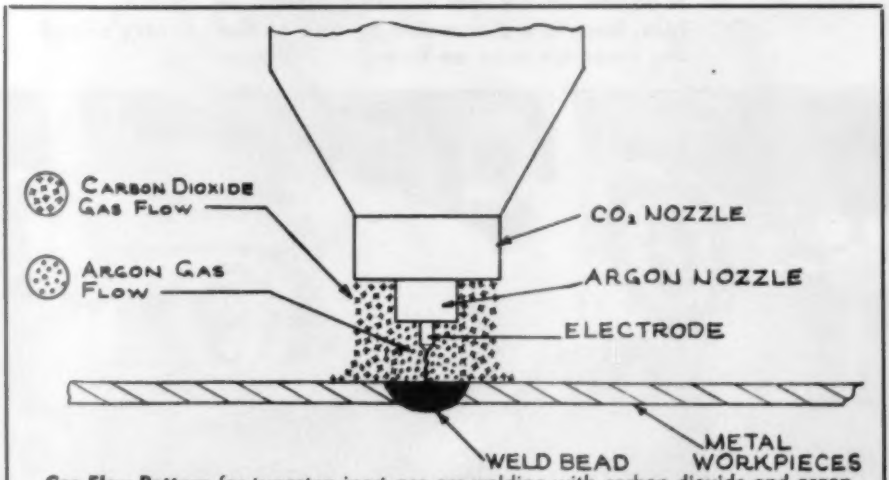
Preliminary tests on horizontal fillet welds have indicated that the grade of steel being welded has a bearing on weld appearance. When fillet welds are made on killed steel, weld metal is said to be usually free of porosity. Size of horizontal fillets which can be produced is limited because weld metal tends to favor the upper leg and thus produce uneven contours.

According to some authorities, chief drawback to the wide use of CO-2 as a shielding gas is its erratic arc action. This results in excessive spatter. Using a short arc, however, and maintaining a constant arc length, help to minimize that problem. A hot and deep penetrating arc is said to be necessary to get good welding quality with CO-2 as the shielding gas.

The A. O. Smith equipment utilizes a constant current power source and a simple rugged, automatic welding head. Designed with gear ratio changes to provide filler wire speeds of six to 600 inches per minute, the head may also be used for submerged arc welding. This is done by making a few minor electrical connections and changing the nozzle.

Other companies which have been actively working on the development of this process are General Electric, Liquid Carbonic and Air Reduction.

For the most part, General Electric and A. O. Smith have concen-




**Gas Flow Pattern** for tungsten inert gas arc welding with carbon dioxide and argon.

trated on the 100% use of CO-2 for shielding. Liquid Carbonic, on the other hand, has thus far limited its efforts to the tungsten inert-arc process, using both CO-2 and argon in a concentric shielding of the arc and weld area.

### Use of $CO_2$ in Conjunction with Argon

Recognizing that CO-2 under heat tends to disassociate (break down into CO and O) as it nears the hot arc stream, Liquid Carbonic developed a concentric dual nozzle. The inner nozzle protects the tungsten electrode with a small volume of argon which prevents its oxidation. The outer nozzle is designed to provide a much greater flow of carbon dioxide which serves as the weld shield.

Care must be taken that the CO-2 is of good quality and "dry" —and that the nozzles are designed for proper shielding. According to Liquid Carbonic engineers, successful test welds have been made, using their process, on both carbon and stainless steels.

Done in accordance with established procedures and techniques, tests have also been made on Inconel, Nimonic and Timken steels. Only variations were in the shielding gas flow. In all cases, these test results have indicated that welds shielded with CO-2 were at least as good as those using straight argon.

Although INDUSTRY & WELDING will present a more complete analysis of General Electric's automatic CO-2 process in a later issue, it is interesting to note some early observations on the part of G.E. welding engineers.

According to these experts, the extra high heat of CO-2 welding, resulting from a necessarily higher practical welding current and arc voltage, produces much deeper arc penetration. Current density must be carefully controlled and kept high. In order to have a burn-off rate, with 3/64" wire, of 520 inches per minute, it takes about 350 amps in a CO-2 shield. With argon the same burn-off rate requires only 280 amps.

*(Please Turn to Page 94)*

**A follow up on last month's article on welding titanium, here is a discussion by one of the country's leading research men on how . . . .**

**Furnace brazing of titanium assembly** is done in protective helium atmosphere. Preplaced silver brazing alloy was tacked in place by resistance welding.

# Titanium Can Be Brazed and Soldered

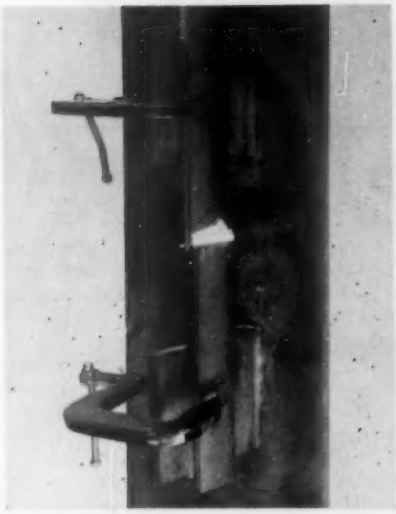
OF eight brazing processes listed in the American Welding Society's Handbook, five can be used on titanium and its alloys. These are torch, twin-carbon arc, furnace, induction and resistance brazing. Dip, block and flow brazing have not been tried. Actually titanium may be brazed or soldered successfully if one has sufficient experience. In fact, it is suggested that samples be joined until the necessary skill is acquired.

by **ORVILLE T. BARNETT**
**Supervisor, Welding Research**
**Armour Research Foundation**
**Illinois Institute of Technology**

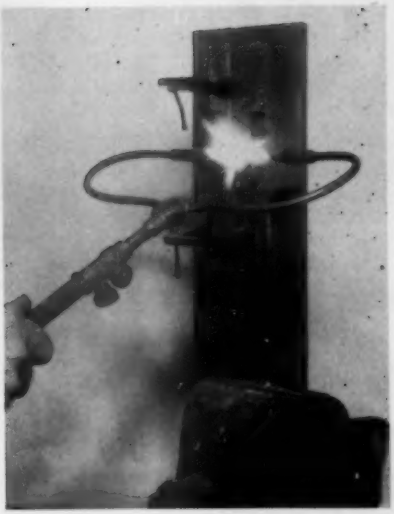
Of many filler metals tried, fine silver appears to give the best combination of strength and ductility. At least one good commercial flux is available for use on titanium, but the metal may be brazed with or without fluxes.

## Braze With Double Torch

Torch brazing of titanium strips,



**When torch brazing titanium,** preplaced flux and filler wire are used. Single oxy-acetylene torch can be used but . . .



**Double torch brazing** is done because faster and more readily controllable heating is required on titanium.

⅛-inch x 1-inch x 6-inch, with a ⅛-inch lap using preplaced filler wire and flux produced satisfactory joints. While a single oxy-acetylene heating torch could be used, faster and more readily controlled heating was obtained with a double torch. Ultimate shear strengths for titanium brazed with fine silver varied from 18,000 to 39,000 psi with the average being above 30,000 psi.

Fractures were ductile. Some flux entrapment was encountered but was not excessive enough to spoil the joints.

The commercial flux used for torch brazing had the following composition: LiCl-50 parts, KF-46 parts, NaF-2 parts, $CuCl_2$-1 part and $SrCl_2$-1 part. It was used in a paste form consisting of 75% solids and 25% water. On heating, the flux melted followed by the brazing filler metal which flowed into the capillary. *In all titanium brazing* the *TEMPERATURE* should be *held to a MINIMUM and the TIME*

**Fluxes for Brazing Titanium with Fine Silver or Brazing Filler Metals**
(Values are in Percentages (Boron Silver)

| Flux | AgCl | $CaCl_2$ | KF | KCl | NaF | LiF | LiCl | NaCl | $SnCl_2$ |
|---|---|---|---|---|---|---|---|---|---|
| A | 10 | | | 36 | | 9 | | 45 | |
| B | 5 | | | 38 | | 10 | | 47 | |
| C | 3 | | | 39 | | 10 | | 48 | |
| D | 4 | 1 | 50 | | | 45 | | | |
| G | | 1 | 46 | | 2 | | 50 | | 1 |

*must be as BRIEF as possible.* This temperature-time condition always suggests rapid heating, short holding cycles and rapid cooling for the best titanium brazements.

### Use Inert Protective Atmosphere

In twin carbon arc brazing the same inert protective atmospheres should be provided as described in last month's article on welding titanium *(Industry & Welding, May, 1955).* In line with the need for rapid heating, the twin carbon arc heat source possesses advantages over oxy-acetylene heating. Less manipulation of the carbon arc torch or the filler metal was required than for oxy-acetylene brazing. Also, the greater heat release of the electric arc promoted better filler metal wetting. Helium or argon may be introduced to include air from the brazing area until the titanium has cooled below 1400°F.

Furnace brazing of titanium and titanium alloys may be done quite successfully provided that all of the problems are understood. A titanium assembly with silver preplaced by resistance welding (welding cycle was adjusted to simply tack the silver in place) was brazed in a stainless steel retort, which has been charged into a hot furnace. Dry helium gas enters through a long pipe and discharges through the loosely fitting retort cover. A thermocouple is threaded through this same pipe with the hot junction adjacent to the titanium brazement inside the retort. And temperature control is exercised by observing the temperature of the titanium brazement itself as this is of critical importance.

### Diffusion is Problem

Diffusion of titanium into the fine silver brazing filler metal is readily seen. In addition, the silver diffuses into the titanium. This is the mechanism that makes furnace brazing of titanium a ticklish operation. If the brazing temperature is too high, the silver will diffuse into the titanium and the two pieces will fall apart. If the brazing time is too long, the same result will follow. So temperatures from 1770° to 1840°F must be employed at times as brief as two to three minutes at the brazing temperature if possible. (Some new alloys make titanium brazing at lower temperatures appear promising.)

So far step brazing in a furnace is impractical. When the second series of joints is being brazed, the prior brazed connections separate. *Excellent temperature distribution throughout the furnace is a must.* Otherwise some joints will braze properly, some will not reach the liquidus temperature of the filler metal and some will fail through diffusion of the filler metal into the base metal. These possibilities are especially difficult with large brazements.

### Induction Brazing is Ideal

The induction brazing process is ideally suited for titanium. Heating rates are extremely rapid, temperature control is quite good and selective heating of the joint in a protective atmosphere is relatively simple. Induction brazed sleeve type specimens between ⅜ in. and ½ in. round bars of commercially pure titanium displayed a good tolerance for heating time and for joint gap variations. Work done at Armour Research Foundation on flat sections with numerous brazed joints indicated that warpage problems may become quite severe. In these applications furnace brazing is the preferred means of controlling warping.

### Resistance Brazing Is Satisfactory

Resistance brazing, too, is a satis-

factory means of joining titanium. Just as in induction brazing, heating cycles not only are rapid but also may be controlled closely. Electrode pressure, current density and time of heating cycle are adjusted to a relationship that melts the brazing filler metal and wets the titanium. Electrode pressure should be great enough to provide good contact without arcing but should not produce excessive forging. Current density should be high to provide a rapid heating rate. Time of the heating cycle should be as brief as possible.

Successful resistance brazed joints were made in titanium with a 60 cycle alternating current, 30 KVA spot welder in which the

**Typical Joint Shear Strengths for Titanium Induction Brazed with Silver For Various Heating Times**

| Heating* Cycle, seconds | Joint Clearance, inch | Average Shear Strength psi |
|---|---|---|
| 7 | 0.001 | 36,000 |
| 9.5 | 0.001 | 35,000 |
| 14.5 | 0.001 | 38,000 |

*Maximum temperature approximately 1800°F.

**Typical Joint Shear Strengths for Titanium Induction Brazed with Silver using Various Gap Clearances**

| Heating* Cycle, seconds | Joint Clearance, inch | Average Shear Strength psi |
|---|---|---|
| 14.5 | 0 | 38,500 |
| 14.5 | 0.001 | 38,100 |
| 14.5 | 0.002 | 34,700 |
| 14.5 | 0.003 | 35,200 |
| 14.5 | 0.008 | 34,200 |

*Maximum temperature approximately 1800°F.

**Ultimate Shear Strength of Resistance Heated Single 3/16 in. Lap Joints Brazed with Fine Silver**

| Specimen Number | Time of Heating, seconds | Ultimate Shear Strength psi |
|---|---|---|
| 1 | 6 | 20,300 |
| 2 | 60 | 23,750 |
| 3 | 72 | 27,200 |
| 4 | 120 | 17,800 |
| 5 | 120 | 16,430 |
| 6 | 240 | 18,700 |

*Specimen Sizes $\frac{3}{32}$ in. . . ½ in. titanium strip.*
*Thickness of Fine Silver Sheet: 10 mils*
*Electrode Pressure: 300 pounds.*

# Soldering requires care and experimentation . . .

control panel was modified to sustain welding currents up to two minutes. The copper electrodes had a contact surface of ⅝ in. x 2 in. Joints of 1 in. x ⅛ in. or ½ in. x $\frac{3}{32}$ in. titanium strips with a $\frac{3}{16}$ in. overlap and the brazing alloy preplaced as a foil were made under automatic control without flux.

Uniform heating of the lap joint is a problem in resistance brazing.

For brazing titanium with fine silver, the metal depositing fluxes provided a thin metal layer which through the mechanism of chemical replacement, removed oxide surface films. The intermetallic was probably formed first at a temperature below the melting point of silver. The mechanism is complicated and is still the object of continuing research.

## Silver is Promising Brazing Alloy

So far fine silver which is ductile, which has a relatively low melting point of 1761° F and which forms a ductile intermetallic, appears to be the most promising brazing filler metal. Due to considerable alloying with titanium during the brazing process, shear strengths for well wetted joints approach and often exceed the tensile strength of fine silver itself.

Brazing alloys present a problem because most metallic elements other than silver produce brittle intermetallic compounds. All of the boron-silver series of brazing filler metals contain copper which erodes titanium severely as well as forming a brittle compound. Boron-copper-phosphorus filler metals are particularly bad for this reason as was a nickel-brass brazing alloy which contained 67% copper.

Titanium base brazing alloys usually have very high melting points. To overcome this objection copper has been added to one composition: Titanium—28%, Nickel—52%, Copper—15% and Cobalt—5% with a practical flow temperature of 1860°F to be sure, and it is reported that the copper content does not prove troublesome.

## Soldering Is Simple

Just as has proved to be the case with the brazing of titanium, soldering techniques require care and some experimentation until a "feel" for the method is developed. Silver, copper and tin films have been deposited on titanium from their fused chloride salts in a helium atmosphere furnace. Also, a simple acetylene torch has been used to deposit a silver film from silver chloride by heating the titanium until the silver chloride melted. Six simple steps are suggested: (1) clean, (2) preplace silver chloride, (3) heat, (4) remove excess silver chloride, (5) flux and (6) solder.

Before depositing the silver film it may be necessary to clean the titanium in an acid such as hydrogen fluoride. A sample can be tried first to determine this point.

Next sprinkle silver chloride on the surface to be soldered. The amount can be evaluated during the testing recommended to attain the necessary skill.

Now the titanium can be heated to melt and flow the silver chloride. With practice silver films can be established in the areas to be soldered.

Excess should be cleaned away by scrubbing, chipping or any other means. Care must be taken to avoid removing the silver film.

A rosin-type commercial flux can be used with 50/50 or 40/60 tin-lead solders. Heat can be supplied from a soldering iron or from an acetylene torch with some preference for the latter.

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WELDING ARCS NEWS

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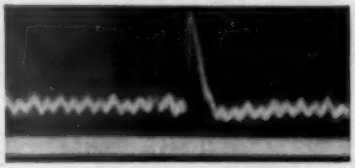

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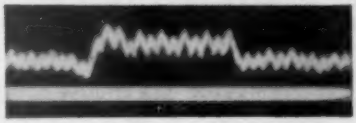

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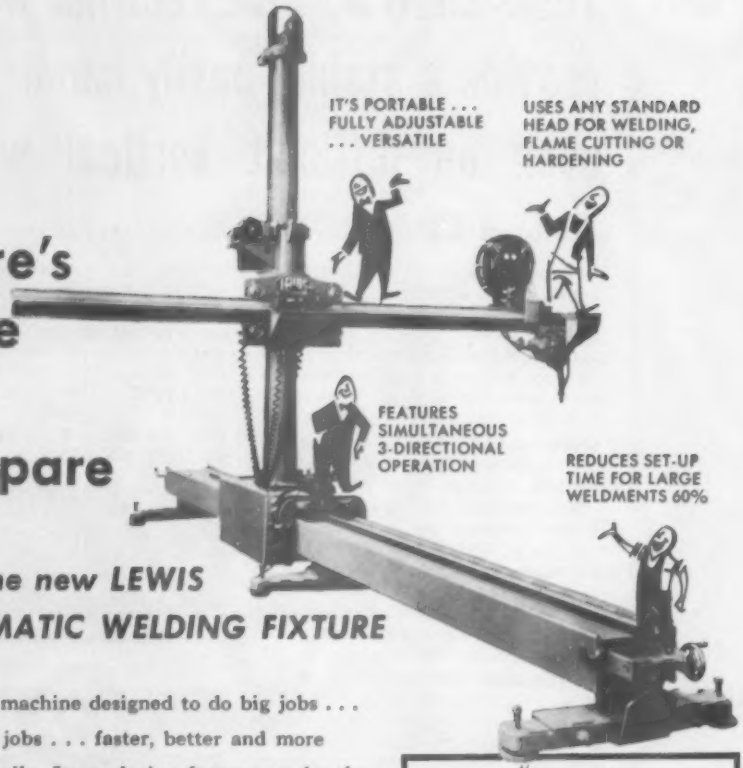
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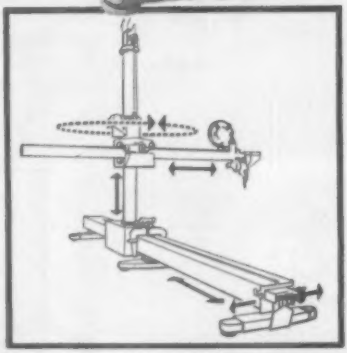

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**This is the first part of an "ABC" series which gives comprehensive practical information on each of the basic resistance welding methods. Here are "step-by-step" instructions on . . .**

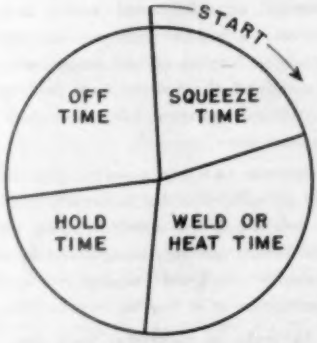
# How and Where to Use SPOT WELDING

SPOT welding is perhaps most commonly used and the best understood. Using electrodes of small face diameter, a spot welding machine concentrates current and pressure on limited areas of flat or semi-flat surfaces, causing them to weld at these spots.

The normal spot welding cycle consists of four phases. The first is squeeze time which is the time between application of pressure and introduction of current. Second is weld or heat time, which is weld time measured in cycles. The third element of spot welding is hold time, which is the time that pressure is maintained after weld is made. The fourth element is off time during which electrodes are separated to permit moving of material for next spot.

Size of electrode, or tip, used is of prime importance. Tips control weld nugget size. To find proper tip diameter for any thickness of SAE 1005-1020 steel from .005 to .125-inches thick the following formula should be used: Tip diameter equals .1 plus total thickness of two sheets. For example, if each sheet is .050, the two together will equal .100 or just .1.

## SPOT WELDING TIME CYCLE




TIMING CYCLE OF SPOT WELD

**SQUEEZE TIME—Time between pressure application and weld.**

**WELD OR HEAT TIME—Weld time in cycles.**

**HOLD TIME—Time that pressure is maintained after weld is made.**

**OFF TIME — Electrodes separated to permit moving of material for next spot.**

Adding .1 to this gives the tip size: .2.

When welding a thin material to a thick material, if no marking is permissible on thick material and flat electrode must be used, calculate tip diameter for thin material, where small diameter tip is used. For example, if .050 must be welded to .250, calculate tip diameter as for two pieces of .050 material.

### Weld Thick to Thin

However, if thick material must be welded to thin material, when large electrode is on thin sheet, calculate as for thick sheet, where small diameter tip is used. For example, if .250 must be welded to .050, calculate tip diameter as for two pieces of .250 material.

If three thicknesses must be welded, add total thicknesses, divide by 2 and calculate as for two thicknesses. For example, if three pieces of .050 must be welded, calculate as .150, divided by 2 equals .075, therefore, tip diameter would be .1 plus .075 plus .075 equals .250 tip diameter.

Nugget size is dependent upon tip size. Material up to .060 yields a weld nugget that is 98 percent of tip diameter. Material over .060 has a weld nugget that is 90 percent of tip diameter. On material over .125 weld nugget is 110 percent of tip diameter.

The second basic factor in spot welding is weld pressure. It forces materials being welded into intimate contact, breaks through oxides and restricts passage of current to the area welded, by pressing sheets together. Pressure also reduces porosity and cracks in weld nugget, decreases tendency of electrodes to stick to metal by maintaining a low value of contact resistance between tips and provides a small deformation in the crystals of the materials to be welded and allows recrystallization across the interfaces.

### Pressure Is Dynamic

Pressure is dynamic, not static, and is materially affected by the friction and inertia of the moving parts of the machine. Mild steel, which has a wide plastic range, can

### WHAT IS RESISTANCE WELDING?

Resistance welding is a method of forging two pieces of metal together with electrically induced heat and mechanically applied pressure. Heat is developed by resistance of the metal to high amperage, low voltage current passed through a limited area where the forge, or weld, is to be made.

Current is applied through suitable copper alloy electrodes under predetermined pressure. When metal reaches a "plastic" state, mechanical pressure causes the two pieces of metal to unite at the weld area.

**This is a union of parent metal. No foreign or additional metal is introduced.** It is much the same as any conventional forging of two pieces, except in the method of applying heat and the fact that steady pressure takes the place of a hammer blow.

Because heat and pressure, and the timing of both, must be accurately controlled in relation to the material being welded, best results can only be attained by use of properly designed equipment and by application of a few basic principles.

To make a successful weld one must control amount of current passed through work, time this current is allowed to flow,

stand many variables in pressures; therefore, static pressure terms can be used, however, in welding aluminum with a narrow plastic range, dynamic pressures must be used.

Static pressures on direct air-operated machines are calculated by cylinder size and head weight. Electrode pressure is measured by multiplying 3.1416 times square of diameter, dividing by four and then multiplying by gauge setting plus headweight. Dynamic pressures are measured accurately by means of pressure gauges, taking into account friction, inertia and head weight by reading a pressure gauge mounted between electrodes.

## Calculate Welding Pressures

To calculate welding pressures for any thickness of steel up to .125 for SAW 1005-1020 steel: pressure equals 6000 times sum of two thickness. For example, 6000 times .100 equals 600 lbs. For various combinations of gauges, use same procedures as used in section on tip diameter.

To find time in cycles for any thickness up to and including .125—SAE 1005 to 1020 steel—multiply sum of two thickness times 100. For example, .050 plus .050 is .100 times 100 or 10 cycles. When welding dissimilar thicknesses always calculate time in cycles for thickness using small tip diameter, as described in section on tip diameters.

Current, in secondary amperes, is found by multiplying sum of two sheet thicknesses times 100,000. In other words, .050 plus .050 is .100 times 100,000 or 10,000 secondary amperes. For dissimilar thicknesses always calculate for thickness using smallest tip diameter, as explained in preceding paragraphs.

To weld high carbon steel, use 90 percent of current used with mild low carbon steel. Use 10 percent more welding pressure because high carbon steel has a high compressive strength. Longer weld time cycles are needed to eliminate brittleness and retard quenching rate of heated material. More spitting and indentation is prevalent due to higher resistance of high carbon steel. Synchronous timing is advisable.

To spot weld terne plate (a steel

---

electrode pressure on work. Reduced to a formula, heat equals $I^2RT$ (K), where I is current in amperages squared, R resistance of work in ohms, T time of current flow and K radiation and conduction loss—heat loss through electrodes and welded sheets.

**Thus heat is proportional to the square of the current. If current is doubled, heat generated is quadrupled.** Total heat is also proportional to total time of current flow. If current is doubled, time can be reduced 40 to 75 percent. However, as time gets abnormally short, current values become abnormally high, so that heat is not generated along the inside surfaces, but throughout the thicknesses, resulting in severe marking and electrode pickup.

**Optimum time and current ratio depend upon the particular application.**

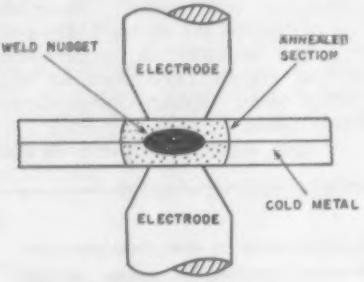
Heat generated by passage of current is directly proportional to resistance. Ideal welding conditions prevail when conduction losses in surrounding metal are held to a minimum by proper water cooling. This also minimizes discoloration and warpage.

These general principles apply to the various forms of resistance welding. These include spot welding, projection, flash and seam welding.

# "Tips are most important factor in spot welding"

coated with a mixture of tin and lead) use approximately 10 percent less current, longer time cycle and about the same pressures as needed for mild steel. It is beneficial to coat tips with terne plate prior to welding. This changes contact resistance at tip and prevents sticking. Hold time is also very important. Use R.W.M.A. Group A —Class 1 electrodes and allow coating of tin and lead to cool and prevent sticking.

It is preferable to use a short welding time of 1 to 3 cycles when welding tin plate. Use 50 percent more current and 50 percent more pressure than with mild steel. Hold time is also important.




TYPICAL SPOT WELD

**A SPOT WELD IS MADE using electrodes of small face diameter to concentrate current and pressure on limited areas of flat or semi-flat surfaces, causing them to weld at these spots.**

Twenty five to 50 percent more pressure than mild steel should be used on galvanized steel. Also use the same ratio of increased current. Time should be moderately short to reduce vaporizing of zinc. Zinc coating on thicknesses up to .078 is not materially affected. Over that thickness, zinc coating is partially destroyed. However, tests have shown that chemical reaction induced by welding retards rust penetration beyond outside surfaces of spot.

## How to Weld Stainless

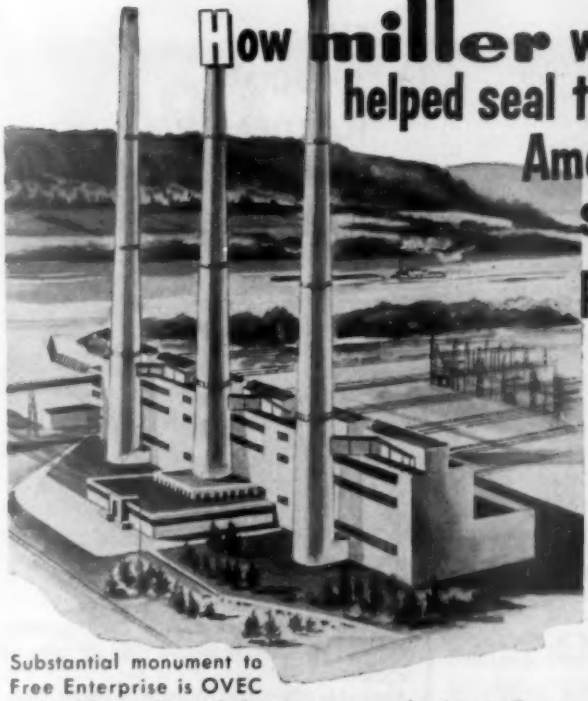
When welding stainless steel (2 percent conductivity — austenitic 18-8), do not use less than 5 cycles of time unless you can control within ¼ of a cycle. Two or three times more pressure is needed than for mild steel. Use 10 to 15 percent less current. Short time is needed because of high resistance; carbide precipitation, which can cause corrosion, is apparent with a long weld time. Hold time is needed to prevent discoloration, which can be washed away by using diluted sulphuric acid. Use R.W.M.A. Group A—Class 2 electrodes.

Copper up to .035 can be spot-welded successfully. Above that thickness, welds are actually nothing more than a "good stick" because of low resistance and high conductivity. Use molybdenum tips. Secondary current should be 6 to 7 times greater than for mild steel. Pressure should be 50 percent more than for mild steel and timing can be the same, depending on sections being welded. Tin coating the faying surfaces often promotes a weld by increasing resistance.

## Zinc Decreases Weldability

Yellow brass with 34-36 percent zinc content is difficult to weld because weldability decreases with decrease of zinc. R.W.M.A. Group A—Class 2 tips have worked out best, but short timing must be used to minimize tip pickup. Pres-

# How miller welders helped seal the arteries of America's largest single purpose power plant...



Substantial monument to Free Enterprise is OVEC and IKEC, suppliers of electric power to the Atomic Energy Commission's new uranium diffusion center in Pike County, Ohio.

Ohio Valley Electric Corporation and its subsidiary, Indiana-Kentucky Electric Corporation, agreed to supply electric power to this great new atomic production center . . . *15 billion kilowatt-hours annually*.

Miller Selenium Rectifier d-c Arc Welder, in four wide-range models. For complete, concise, worthwhile information on these and other Miller Arc and Spot Welders, contact us today . . . at no obligation, of course.

Two huge generating stations are being built: The Kyger Creek Plant at Cheshire, Ohio will have five generating units of 200,000 KW each; Madison, Indiana's Clifty Creek plant will produce 1,200,000 KW with its six big generators. Each of the eleven turbo-generating units will operate off a single boiler, with super-heated steam reaching 1,050 degrees Fahrenheit under 2,000 lbs. pressure per square inch! The high temperatures and reheat, which the sponsor companies have pioneered in their own right, will make these two plants among the most economical, most efficient generating stations in the country.

These same elements, however, make the fabrication of faultless high-pressure steam lines vital . . . and extremely difficult. To accomplish this extremely important task, pipe welding specialists equipped with the maximum of engineering skill utilized the Miller Selenium Rectifier d-c Arc Welder.

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**miller** ELECTRIC MANUFACTURING COMPANY, INC.
APPLETON, WISCONSIN

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sures and current are about the same ratio as used for copper.

Red brass with 15 percent zinc content should be welded with Group B—Class 11 electrodes to localize heat. Otherwise use same values as with yellow brass.

Aluminum (35 percent conductivity) requires pressures about the same as for mild steel, but time should be about 40 percent less and current about two or three times greater. These values are for cone tips of 7° or 11°. For radius tips more current and pressure is required. Less current and more pressure is required for 24ST Alclad. For 2S material use 40 percent less pressure, other values about the same.

## Magnesium is Easy to Weld

Magnesium lends itself to A-C resistance welding very well because its lower electrical conductivity requires a lower current density. Synchronous timing is necessary, however, to insure consistent results. Pressures used are slightly less than for aluminum and currents are also slightly less.

To spot weld .020 magnesium it would require about 3 cycles, about 300 lbs. pressure and about 14,000 secondary amperes. To spot weld .100 magnesium, use approximately 8 cycles, 800 lbs. pressure and about 25,000 secondary amperes.

To insure consistent welds and minimum electrode pick-up, magnesium should be cleaned, preferably by wire brushing. Electrodes can be either a radius face or a conical shape of about 11°.

Material presented here was prepared by engineers at Federal Machine and Welder Company, Warren, Ohio.

**Next Month: Pulsation Spot Welding**


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**Hardfacing Rods and Electrodes . . .** A complete line of manual and automatic build-up and hardfacing materials. One for every repair job. Amsco rods and electrodes contain alloys of the toughest, hardest metals known. Amsco manganese steel rods are also available.

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**Amsco Repointers . . .** Add the long wearing quality of manganese steel to digging equipment. All you do is weld them on. Available also are rounds, squares, flats, plate, grouser bars and electrodes—all made of manganese steel.

**Semi-automatic MF Welder . . .** Uses entirely new principle of magnetic flux welding that permits you to step up weld deposit rate, increase welding speed during hardfacing or build-up. Welders connect to any standard AC or DC welding machine.

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Welder is shown welding a "wear-sharp" repointer to the shank of a dipper tooth using the Amsco MF and flux.

# HARDFACE WITH THE AMSCO® MF

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The Amsco MF combines the visibility and craftsmanship of hand welding with the automatic advantages of machine work. Speed of hardfacing increases because the Amsco MF uses small-diameter electrode and high-current densities which allow the operator to maintain a high deposit rate. The electrode feed is continuous—and automatically regulated—to maintain a constant arc. Thus, the machine automatically *compensates* for operator movement or an irregular welding surface.

Cost of deposited metal is less! The Amsco MF uses coiled, bare mild steel electrode. It feeds through the flux hopper (the cone). There it is magnetically coated with your choice of manganese steel build-up or hardfacing alloy which is carried in the flux. You coat your electrode as you weld at considerable savings in deposit cost.

The machine is portable. It plugs into any standard welding unit, and requires no special setup. See a demonstration of the Amsco MF's speed, quality of weld and uniform deposit. Try it yourself and discover how easy it is to operate. Your Amsco Distributor is ready to show it to you now. Welding products are distributed in Canada by Canadian Liquid Air Co., Ltd.

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# STAINLESS STEEL FINISHING

**Here is a practical handbook on stainless steel finishing, reduced to a few minutes reading time . . .**

THE stainless steel fabricator has four important decisions to make before he can begin to plan his finishing operations. First he must determine how fine a finish the completed product must have. Then he must select the type and grade of stainless steel sheet to be used. Next, the proper abrasive must be chosen. Finally, the details of application must be set.

Abrasives must be of correct grit size and used in correct sequence. Wheels, discs or drums must be of a type best suited to the particular job. Portable machines that serve as driver and vehicle for abrasive must be easy to handle, capable of a wide range of speeds, and versatile enough to be able to use a variety of attachments with little loss of time.

Stainless steel comes from the mill in a variety of standard finishes and a number of analyses. For this reason, it may be neces-

# 9 TIPS FOR BETTER STAINLESS STEEL FINISHING

1 **Avoid overheating** the metal. Temperatures above 150° F may cause wrinkling, buckling and discoloration.

2 **Break in a new disc** or sleeve on a scrap of the same metal to be finished later.

3 **Keep scratches parallel.** Proper handling of the tool will avoid gouges, chatter and herringbone scratches.

4 **Avoid uneven wear** on emery sleeve, wheel or disc face.

5 **Do not attempt to remove too much** with fine grit. If much stock must be removed, do so in gradual abrasive steps. This eliminates overheating and is more economical.

6 **Stroking motion** should be used in setting tool down on work. Keep stroke speed uniform and lift tool before reversing. Do not dwell in one spot.

7 **Use coarsest grit** size consistent with finish requirements—for speed and economy.

8 **In testing** to determine proper grit, do not use worn sleeve or disc if fresh one will be used on actual job.

9 **First lubrication** or appliation of compound to a disc or sleeve should be thorough and uniform.

sary to experiment a little before adopting exact steps that suit particular conditions. Nevertheless, certain general methods may be outlined.

Once specifications are set for the finished product and the type of stainless steeel has been selected, proper abrasives must be chosen. Vitrified, resinoid and rubber bonded wheels have all been used. While resinoid and rubber bonded wheels have proven best for all around work because of their greater resiliency, vitrified wheels are often used for initial rough grinding. Size of wheel will depend on spindle speeds available.

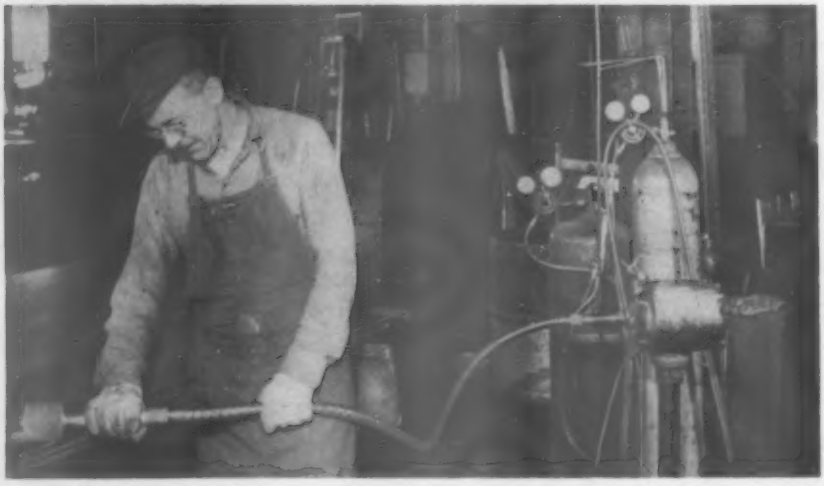
Whatever the wheel chosen, if it is to be used on stainless steel, it should never be used for other metals. Wheels should be frequently dressed. Only those screened for grit size uniformity should be used. Each grit size should be kept separate. Wheels should be trued for round, and edges rounded to prevent gouging.

High speeds are best for rough grinding. If vitrified wheel is used speed should be held at 4000 to 6000 surface feet per minute. Rubber bonded or resinoid wheels can be run faster—up to 9000 surface feet per minute. These high speeds cause the wheel to cut fast, generating less heat and subsequently requiring less work in final polishing. Allow the wheel to "ride" on the work, so grits do their cutting job at recommended speeds. Do not allow wheel to dwell.

### First Steps

Assuming welds have been made properly and sheets have a mill finish, it is first necessary to snag off excessive weld metal with a straight or cup type wheel. This wheel should have aluminum oxide

**Flexible shaft equipment** gives operator freedom of movement, ample power.



No. 16 to 36 grit. On larger areas, a sanding disc with No. 24 to 36 grit may be used. With this coarse grit, grind off all high spots along the weld until bead is cut down to about $\frac{1}{16}$" above surrounding surface.

Next use a finer grit (No. 60 to 80) rubber-bonded straight wheel, having a face slightly wider than the bead. Grind the bead flush with adjacent surface, moving along the weld, not across it. This is essential since it is difficult to avoid gouging surrounding metal when the wheel runs across the bead. Grinding should be carried out continuously, the passes overlapping. If area becomes overheated, temporarily move to another section.

Now it is necessary to change over to rubber sanding drums and abrasive sleeves or belts. Here it may be advisable to experiment to find the proper grit. If final wheel grinding was done with a 60 grit, try an 80 grit abrasive sleeve on the sanding drum. Eliminate any remaining uneven spots along the weld and blend with lines of sanding parallel to the polishing lines of surrounding metal.

Follow up with a finer grit belt or sleeve, having 120 or 180 grit, depending on the job. Closely observe original polishing lines in the metal. Quality of the finish attained will depend on how well new and old lines match.

### Lubrication Helps

A finer finish may be obtained with the same belt or sleeve operation if the abrasive is lubricated. For this purpose, however, do not use solid mineral lubricants as they clog the abrasive and tend to retard cutting action. Many plants find it economical to use partially worn dry emery sleeves during this lubricated sanding or blending operation.

**Disc sander** mounted on flexible shaft machine is used by operator to finish piece of cafeteria equipment. Note use of goggles and respirator.

After all imperfections have been removed and a clean, uniform base secured, polishing operations can be begun. Polishing can be conducted with soft, well ventilated fabric wheels using fine abrasives and a lubricant. Wheels for polishing are made of sewed sections of unbleached muslin. Spacers, usually cardboard, are inserted between sections to ventilate the wheel. Wheel speeds of 7000 to 10,000 surface feet per minute are suggested.

Polishing abrasives combined with lubricant are supplied commercially in convenient stick or cake form. Application to the wheel surface is a simple matter of holding the stick against the rotating

## Applying pressure when buffing causes "burns" . . .

wheel. Care should be taken to distribute the compound evenly over the face of the wheel.

It is good practice to conduct each succeeding step with abrasives from 20 to 40 grit numbers finer than preceding grits. Do not attempt to shorten operations by skipping intermediate steps. Wheel pressure should be as light as possible at all times. Be careful not to overheat work metal. Do not dwell in one position. Use long even strokes.

In polishing, if a standard No. 4 finish is desired, the surface must be polished with a No. 120 grit compound. To produce commercial No. 7 finish, the surface is polished with Nos. 150, 180 and 220 grit compounds. This operation should be followed by use of No. 320 grit compound with a heavier base.

The next phase of finishing is buffing, an operation usually performed in two stages. Success depends largely on proper wheel selection. For the first or "cutting" stage, sections of bleached muslin or linen that are sewed spirally for one or two rows around the arbor hole are recommended. The wheels should be built up quite loose and soft, as they will become sufficiently stiff for polishing when rotating at high speeds. Ventilation is secured by inserting cardboard spacers or worn down sections between pieces of new cloth. For the second stage (called "color" buff) wheels are basically the same, but cloth sections should remain unsewn.

**Abrasive sleeve** is used to rough grind corners on this stainless steel panel. Face shield protects operator's eyes.

### Wheel Speed

These wheels should be used at very high speeds—about 9000 to 12,000 surface feet per minute. In the first stage a compound known as "cutting rouge" is applied. In the second, a milder abrasive compound called "color rouge" is used.

It is essential that operators do not attempt to hasten the buffing operation by applying pressure to the wheel. To do so may "burn" the surface and ruin careful preliminary work. Heat resulting from high pressures and speeds, if not controlled, may cause slight buckling, surface roughening, and off color work.

This covers the finishing process from rough grind to buffing. Today, however, satin finishes, requiring no buffing, are being increasingly specified where mirror bright surfaces are not demanded. With this growing popularity, the use of wicking wheels has gained favor. A few passes with a wicking wheel may be all that is needed to provide a dull satin finish.

This type of finish saves money,

*(Continued on Page 152)*

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## for longer runs and lower costs

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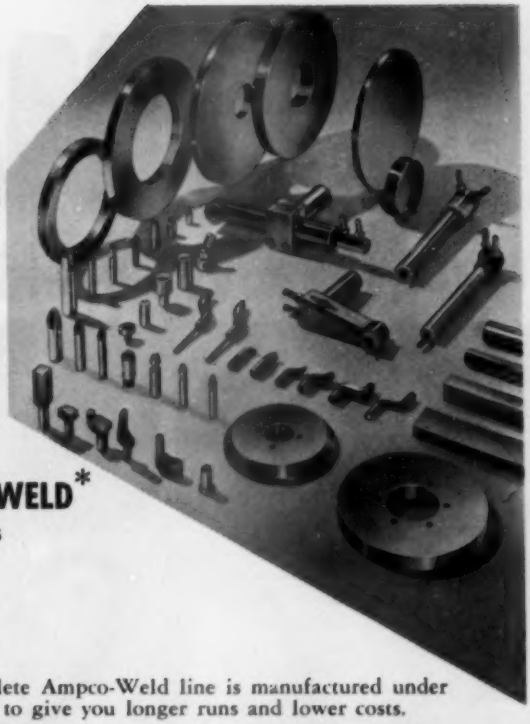

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# THE DC

**A loud chorus of claims and counterclaims accompanied introduction of the DC rectifier arc welder. Here are the facts—draw your own conclusions.**

INTRODUCTION of the rectifier type DC welder has been accompanied by a loud chorus of claims and counter claims. In the welter of conflicting opinion it is difficult to steer a straight course. One fact stands out. The rectifier type welder is meeting with greater acceptance every day. This indicates that the machines are filling at least some needs of industry—and filling them well.

As late as 1950, The American Welding Society's *Welding Handbook* said of these machines: "With few exceptions, they have been made only for current ratings not included in standard lines of AC and DC welding machines". Today however, the welding fabricator has a wide variety of rectifier type welders from which to choose, even within the most common current ranges. At least a dozen brands are on the market, and by June 1953 this type of machine accounted for 41% of all DC welders sold, according to one informed estimate.

One reason for the ready acceptance is their relative simplicity.

# RECTIFIER ARC WELDER

## AN INDUSTRY AND WELDING REPORT

This was made possible by development of the higher voltage selenium rectifier cell. Until then, other type rectifiers tried were found to be too large and unwieldy, too expensive, or otherwise unsuitable. Even tube rectifiers were tried with little success.

Today rectifier welders are available in both three phase and single phase models. Three phase models, however, are most common. All rectifier machines have two basic components: a transformer for regulating current and a rectifier stack for converting AC to DC. Some machines also have a saturable reactor.

As the alternating current enters the machine, it passes into the transformer. From there it flows to the rectifier stack.

The rectifier serves the same function as commutator and brushes on a rotating generator. Alternating current is induced in the armature winding of the generator and is rectified by the commutator. Likewise, alternating current is induced in the secondary windings of the transformer and is commutated by the rectifier.

A third component of all rectifier welders is a ventilating fan. While secondary to the actual welding function of the machine, a fan is needed to keep the stack at proper temperature since overheating will shorten its life considerably.

The various brands on the market also offer a wide range of special features and optional equipment. Most manufacturers, for example, offer some sort of thermal overload protection — some device

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to cut off the machine before the stack overheats. Some models provide polarity reversal switches, while others feature special arc force controls to provide deep penetration for such jobs as pipeline root passes and difficult overhead and vertical work. Others are available with optional remote control units and a variety of automatic controls. Still another machine offers a choice of AC or DC and has a device which gives "hot" start arc striking.

### Similarity In Designs

Yet with all the accessories and specialized features the basic design remains necessarily the same. This general type of construction, like any other, has its own distinctive operating characteristics. These determine applicability. One of these distinguishing characteristics of the three phase bridge rectifier is the fact that it does not convert 100% of input to DC. The theoretically perfect three phase bridge rectifier converts 95.8% of input to DC, thus allowing a 4.2% carryover of AC component. This figure, it should be noted is based on the perfect rectifier receiving pure AC current—not AC current after it has gone through a transformer or a reactor. In practice, AC carryover at the arc varies from 15% to 20% average, and in some cases, depending upon the type of control used, may be quite high. This gives the direct current line a pronounced ripple or pulsation.

### Ripple Effect

There may be some arguments as to whether this ripple is responsible for the reduced arc blow effect which has been observed by some operators in connection with rectifier welders. Technically, the reduction could be in proportion to the percent of ripple.

Actually, the whole question of the significance of ripple with regard to magnetic arc blow is still a subject of controversy. One manufacturer reports, "Our tests show the ripple has no effect on arc blow." Another says, "The higher the amount of ripple, the more you might run into arc stability problems, and also the more freedom you will have from magnetic blow." A third writer claims, "This slight ripple has a tendency to reduce arc blow when welding in closely controlled position."

The simple rectifier design has the ability to withstand repeated high short circuit loads. It offers instantaneous voltage recovery which increases arc stability and makes it easier to hold a short arc. The arc itself is soft and steady. Furthermore, rectifier machines offer stepless control over an extremely wide current range. This, of course, adds to their all around usefulness.

The rectifier types, having no major rotating parts, offer low idle time power consumption, operate more quietly, and function with low starting current. Moreover, they may be paralleled for increased current output.

### Applications

These characteristics help determine possible applications. Practice has already indicated the wide range of applications possible with rectifiers. In addition to manual operation, the machines have been used in inert-arc welding with both consumable and non-consumable



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wire, as well as with submerged arc welding in plants where line voltage conditions are stable.

They have been employed for stud welding, as a power source for melting titanium, and in magnaflux testing. In field construction work a whole bank of rectifiers may be hooked up to a diesel driven AC generator.

In manual operation the list of electrodes—both straight and reverse—that have been used is long and growing. Mild steel, stainless, low hydrogen, low alloy and iron powder coated electrodes are a few of the many successfully applied. The machines have also done well with hard to weld metals like aluminized steel.

Rectifier units have proved extremely versatile, with certain very valuable operating characteristics. How do they stack up economically?

## Rectifier Economics

In determining economy there are three main areas of cost. First there is the initial cost of equipment. A recent check with leading distributors indicates both types cost very nearly the same, some companies even pricing their motor generator and rectifier models exactly alike.

It is in the second area, that of operating efficiency, that advantages appear. One major user of motor generator equipment recently conducted an efficiency study. Taking into account current losses in the motor proper, in the generator, and losses due to stray fields set up during the course of generating current, this company estimated that its motor generator equipment operated at 52 to 57% efficiency. Two leading motor generator manufacturers provide additional data on the subject. One claims 60 to 65% efficiency for its machines, the other suggests 55 to 65% as common for motor generator sets. In a comparative study, rectifier type equipment, with its simpler construction, operated at 64 to 72%. Here again, one of the above manufacturers gives 60 to 70% as rectifier efficiency. There is not too much disparity about these figures.

Another study by the same company, in cooperation with others, produced figures indicating that the cost of operating a DC rectifier for eight hours at a duty cycle of 40% and at a power cost of .02 per kilowatt hour was $1.16. Given the same preconditions, the cost of operating a motor generator unit was somewhat higher. An added reason for this difference lies in the lower idle time power consumption of the rectifier type machines.

## What About Maintenance?

The third area for cost comparison is in maintenance. Maintenance on some motor generator welders requires replacing brushes, inspecting and cutting the commutator, lubricating bearings and blowing out dust. Proper preventive maintenance suggests such inspection at least once a month.

In a rectifier type, on the other hand, there are no moving parts except for the cooling fan. Most such fans come with sealed bearings and prelubricated motor, so for practical purposes there is no maintenance problem here. In fact, users report that the only maintenance necessary is a periodic blowing out for dust removal. At least one manufacturer offers a cleaning-cooling fan with their machine. Cleaning is performed in a few seconds by changing the ventilating fan into a blower at the touch of a switch. This need be done only once every few months.

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# Originators not Imitators

*"Every kind of imitation speaks the person that imitates as inferior to him whom he imitates, as the copy is to the original."*

LORD SOUTH

R. D. Wasserman

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U. S. Patent #2,288,869. First Torch Alloy for joining cast iron with color match, without fusion.
U. S. Patent #2,471,803. First "Low Amp" coating for metal arc welding of cast iron.
U. S. Patent #2,632,000. First low-melting electrode for high strength joining of aluminum.
U. S. Patent #2,632,835. First "Low Amp" electrode coating for high alloy steels.
U. S. Patent #2,626,339. First electrode for high tensile strength joining of copper.

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Figures based on this kind of breakdown show that rectifier maintenance cost, under normal conditions, is extremely low.

### Life Expectancy

Another factor to be considered is durability. The rectifier type unit, having no rotating parts to wear, presents only one important problem in this respect. This is the question of stack life. Critics of the rectifier point to stack failure and selenium rectifier "aging" as weak spots in the picture. They claim that the relative newness of the rectifier machines precludes any conclusive proof as to their lasting qualities. They view the new machines as being more susceptible to extraordinarily high temperatures, corrosive atmospheres and dirt than the generator type equipment. One estimate places rectifier life at only one-third or one-half that of the older type machines.

On the other hand, the machine's exponents claim that initial "bugs" in stack production have been ironed out. More uniform selenium coatings, taken together with improved thermal overload protective devices and general refinements in cooling design have licked the problem of stack "burnouts", they claim. As proof they point to the 5 year pro-rated guarantee that some manufacturers now offer on their rectifiers.

### Aging—How Important?

As for rectifier "aging", it is known that the selenium stack loses a certain amount of efficiency with age. There is a rise in the resistance of the rectifier plates with age. This is said to result in a decrease in the maximum output

and increased heating of the rectifier plates at a given load.

Defenders of the rectifier, however, point out that this well known "aging" process is of little practical importance. One estimate put it this way: ". . . after 10,000 hours of operation the decrease amounts to 4% . . . In shops achieving a high duty cycle of 37.5% working 250 days a year, it would take 13.3 years of one shift operation to reduce the output current from 400 amperes to 386 . . . Practically, the factor is unimportant."

In reply to the charge that selenium stacks are sensitive, they note that every pullman car has a selenium rectifier suspended beneath it in a perforated metal cage, exposed to the elements and vibration. They point to many years of trouble-free service these units have given.

Thus there are still areas of controversy in any discussion of the rectifier welder. Nevertheless certain facts stand out. Selenium rectifier type DC welders offer a combination of versatile performance and all around economy that cannot be ignored. As a result, with most major producers marketing one or another type rectifier machine, with the rectifiers claiming more and more of the market, one thing is sure. Rectifier type DC welders are here to stay.

• *Acknowledgement for valuable cooperation in preparation of this survey should go to General Electric Co., Harnischfeger Corp., Hobart Bros. Co., Lincoln Electric Co., Metal & Thermit Corp., Miller Electric Mfg. Co., A. O. Smith Corp., Vickers, Inc., Westinghouse Electric Corp.*

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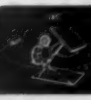

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## $CO_2$ WELDING . . .

*(Continued from Page 61)*

It is the opinion of G.E. engineers that higher currents used in CO-2 welding tend to create violent agitation of the molten pool and permit more CO (carbon monoxide) to escape. The method may thus be very effective in reducing porosity caused by entrapment of CO when the molten pool freezes too quickly.

The question of toxic effects of CO-2, a very important one, has produced considerable discussion. It is generally acknowledged that adequate ventilation is necessary for operator safety. In some cases, where large quantities of ozone may be generated by the arc, it is necessary that better exhaust facilities be provided. Aside from this factor it is agreed that CO-2 welding is no more dangerous than any other process.

Will CO-2 replace argon and helium as a shielding gas in inert-arc welding? Perhaps it will eventually, but not for a while yet. There are still many questions to be answered; many problems to be solved. Until then, the general efficiency and effectiveness of conventional inert-gas arc welding, on a wide variety of metals, cannot be challenged.

But CO-2 welding, on a much broader scale, is certainly on the way. It is still the "hottest" new development on the horizon. It will continue to merit the close attention of all welding users. Watch for further coverage of the subject in an early issue of INDUSTRY & WELDING.


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## N.W.S.A. Convention Notes

E. C. Caluwaert

"The Life of A Salesman", which featured talks by outstanding authorities in the sales field, was one of the highlights of the 11th Annual Convention of the National Welding Supply Association held in Chicago last month. A near record number of delegates heard how they could increase sales and operating efficiency.

The program was arranged by a Convention Committee headed by N.W.S.A. Vice President E. C. Caluwaert, O.K.I. Welding Supply Co. He was assisted by Les Dlouhy, A. J. Fausek, N. C. Miller, H. R. McGarvey, F. J. Hupertz and C. E. Dennis.

Another outstanding feature of the convention was the Association's 6th annual Contact Booth Program. Booths were set up by 88 of the leading manufacturers in the welding industry to give manufacturers, distributors and users a chance to get together on mutual problems.

Convention was presided over by N.W.S.A. President James N. Alcock, Saginaw Welding Supply Co.


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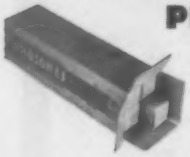

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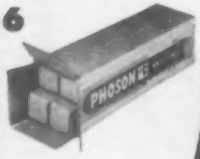

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A recent series of test welds were made in joining 3/8 by 5 by 12-inch plates of different compositions. These included welding mild steel to stainless and stainless to "Croloy," Monel, Inconel, Hastelloy and other stainless types. Joint design called for a single Vee joint with 80° included angle and 1/16-inch root face. Joints were assembled with 3/32-inch root spacing.

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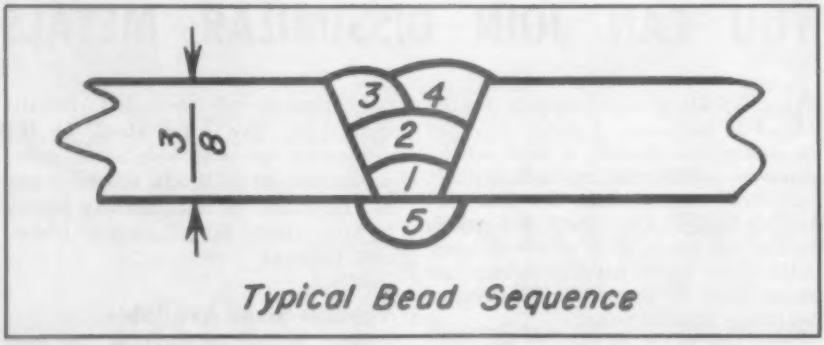


*Typical Bead Sequence*



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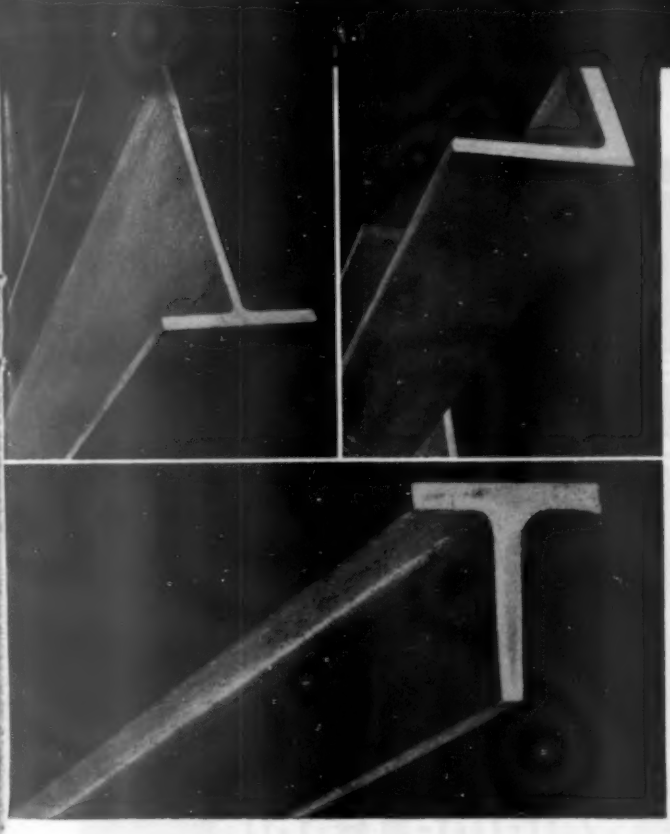

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New applications of the welding process for industry will be the theme of the American Welding Society's Welding Show to be held at the Municipal Auditorium, Kansas City, Mo., June 8 to 10. Technical sessions of the Society's National Spring Meeting, which starts a day earlier, also will emphasize new uses for welding.

Outstanding innovation this year is a three-day conference which is to be conducted in addition to the technical sessions. This conference will include a practical session for factories dealing with everyday welding problems; a session on the new field of welding plastics, and a final session looking forward to automation in welding.

Some 3,000 items of welding equipment and accessories will be on exhibit in the booths which will comprise the largest welding show held thus far. About 800 leading engineers will be on hand to greet visitors, guide them through exhibits and answer technical questions about welding methods.

Among other events scheduled, in addition to the show, the Spring meeting and the welding conference, are the Society's annual meeting, a banquet, the first national sustaining members luncheon, a barbeque and a president's reception, the outstanding social event of the year for the society.

**10-PAGE GUIDE TO THE SHOW** . . . this is the first of 10 successive pages of information on technical program and exhibitors at the third "All Welding" Show. Take these pages with you. They will be of value in helping you use your time to the best advantage.

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# Tentative Technical Program

# AWS National Spring Meeting

**Kansas City, Mo.**

**June 7, 8, 9, 10, 1955**

## June 7, Tuesday Afternoon—Three Simultaneous Sessions

### 1. INERT ARC WELDING

A. Some Fundamentals of Inert Gas Arc Welding by H. C. Ludwig, Westinghouse Electric Corp.

B. Electrode Activation for Inert-Gas-Shielded Arc Welding by Alexander Lesnewich, Air Reduction Co., Inc., Research Labs.

C. Inert-Gas Welding in the Aircraft Industry by John M. Thompson, Jr., Convair.

### 2. RESISTANCE WELDING

A. The Flash Welding of Commercial Molybdenum by E. F. Nippes and W. H. Chang, Rensselaer Polytechnic Institute.

B. The Static and Fatigue Behaviors of Spot-Welded Joints in Titanium by W. H. Kearns, W. S. Hyler and D. C. Martin, Battelle Memorial Institute.

C. Oscillographic Instruments in Spot Welding Quality Control and Maintenance by G. C. Woodmancy, Boeing Airplane Co.

### 3. WELDABILITY AND RESEARCH

A. Effect of Welding on Transition Temperature of Nickel Steel Plate by T. N. Armstrong, International Nickel Co., and W. L. Warner, Watertown Arsenal.

B. Initial Characteristics of Chromium-Nickel Steel Weld Metals by J. Heuschkel, Westinghouse Electric Corp.

C. Properties of Stainless Steel Welds at Ambient and —40° F Temperatures by V. N. Krivobok, International Nickel Co., and A. Choquet and G. Welter, Ecole Polytechnique.

## June 8, Wednesday Morning—Three Simultaneous Sessions

### 4. INERT ARC WELDING

A. Carbon-Dioxide-Shielded Consumable-Electrode Arc Welding by Gilbert R. Rothschild and Harry C. Cook, Air Reduction Co.

B. A Straight Polarity, Inert-Gas Process for Welding Mild Steel by J. M. Cameron and A. J. Baeslack, Westinghouse Electric Corp.

C. Consumable - Electrode Inert-Arc Spot Welding by R. L. Hackman, Linde Air Products Co.

# 13 Technical Meetings Cover All Phases

**5. WELDABILITY AND RESEARCH**

A. Weld - Metal Flaw - Evaluation Studies by R. S. Ryan and P. J. Rieppel, Battelle Memorial Institute.

B. Investigation of the Importance of Quench Aging in ASTM A-300 by E. F. Nippes, Rensselaer Polytechnic Institute, and W. Fleischmann, Knolls Atomic Power Laboratory.

C. Investigation of Weld - Metal Cracking in High - Strength Steels by R. P. Sopher and P. J. Rieppel, Battelle Memorial Institute, and A. J. Jacobs, Ohio State University.

**6. STRUCTURES**

A. Static Tests of Arc-Welded Aluminum Alloy Beams by M. Holt and R. B. Matthiesen, Aluminum Company of America.

B. Welding of Plate Girder Bridge by Submerged Arc Welding by J. A. Hoffman, Bethlehem Steel Co., Shipbuilding Div.

C. Maintenance Welding and Cutting Operations on Radioactive Process Equipment by E. B. LaVelle and J. M. Fox, Jr., General Electric Co.

## June 8, Wednesday Afternoon—Three Simultaneous Sessions

**7. SYMPOSIUM ON QUALIFICATION**
**Sponsored by Technical Activities Committee.**

A. Basic Philosophy.

B. Application to Arc and Gas Welding.

C. Application to Resistance Welding.

D. Application to Brazing Processes.

E. Application to New Welding Processes.

Speakers to be announced at a later date.

**8. AIRCRAFT AND ROCKETRY**

A. Fusion Welding Unalloyed Titanium Sheet Without Filler Metal by A. V. Levy and R. Wickham, Marquardt Aircraft Co.

B. Titanium Alpha and Alpha-Beta High Strength Alloy Fusion Weldability by H. L. Meredith and C. W. Handova, North American Aviation, Inc.

C. Inert-Gas Consumable Electrode Arc Welding of 4130 Steel by C. R. Sibley and D. R. Kelker, Air Reduction Sales Co.

**9. PROCESSES**

A. Surfacing with Composite Tube Rod by R. P. Culbertson, Haynes Stellite Co.

B. Evaluation of Fuels and Oxidants for Welding and Associated Processes by Walter B. Moen and John Campbell, Air Reduction Co., Inc.

C. High-Speed Welding of Light-Gage Material by R. A. Kubli and T. McElrath, Linde Air Products Co.

# of Welding, Cutting and Brazing

## June 9, Thursday Morning—Two Simultaneous Sessions

### 10. PRESSURE VESSELS

A. Properties and Characteristics of a Quenched and Tempered Steel for Pressure Vessel Construction by W. D'Orville Doty, United States Steel Corp.

B. Pressure Vessel Design Using High-Strength Quenched and Tempered Steel by L. P. Zick, Chicago Bridge & Iron Co.

C. Suitability of Quenched and Tempered Steels for Pressure Vessel Construction by Leon C. Bibber, United States Steel Corp.

### 11. WELDING ELECTRODES

A. Hardenability Evaluation of Welding Electrodes by Leo M. West, Douglas Aircraft Co.

B. Evaluating the Iron Powder Coated Electrodes for Production Use by D. B. Howard, ACF Industries, Incorporated.

C. The Effect of $I^2R$ Heating on Electrode Melting Rate by J. L. Wilson, G. E. Claussen and C. E. Jackson, Metals Research Labs., Linde Air Products Co.

## June 10, Friday Morning—Two Simultaneous Sessions

### 12. PIPING AND PIPE LINES

A. Inert-Gas Tungsten Arc Welding of Piping by H. Thielsch and C. S. Pulliam, Grinnell Co., Inc.

B. Stringer Bead Welding of Carbon Steel and Low-Alloy Pipe by Inert-Gas-Arc Welding by J. Neal, The Fluor Corp.

C. Temper Brittleness of 1 Cr—½ Mo Weld Metal by W. J. Lester and G. R. Prescott, C. F. Braun & Co.

### 13. BRAZING

A. Lithium Additions to Brazing Alloys by N. Bredzs and D. A. Canonico, Armour Research Foundation.

B. A Metallurgical Study of Silver - Cadmium - Copper - Zinc Brazing Alloys by K. M. Weigert, Goldsmith Bros. Smelting & Refining Co.

C. Semi-Automatic Multiple Flame Brazing Larger Brass Electronic Components by J. W. Weyers and L. E. Mills, General Eletcric Co.

## WHAT TO SEE AT THE SHOW

**Exhibitors listed on next page will featured equipment, accessories and products for use in arc welding, inert arc welding, oxy-acetylene welding, cutting and brazing and resistance welding.**

**If you were unable to attend the show and would like additional information about new developments on products exhibited, circle the corresponding numbers on Readers' Service Card bound into this issue.**

# These Companies Are Exhibiting at

**ADVANCE GLOVE MFG. CO.** ..... Booth No. 208
Gloves for welding and other industrial uses will be shown.
**Circle No. 190 on Reader Service Card.**

**AIR REDUCTION SALES CO.** 254-255
No. 48 Duograph flame cutting machine, new contact electrode,

Aircomatic, Heliweld and Aircospot processes will be demonstrated.
**Circle No. 191 on Reader Service Card.**

**ALLOY RODS CO.** ..... 227-228
All position iron powder low hydrogen electrode and low alloy electrodes with iron powder coating will be demonstrated.
**Circle No. 9 on Reader Service Card.**

**ALL-STATE WELDING ALLOYS CO., INC.** ..... 205

"Jet Flux" liquid and dispenser which fluxes brazing work automatically through fuel gas is introduced.
**Circle No. 58 on Reader Service Card.**

**ALUMINUM CO. OF AMERICA** ..... Booth No. 233-234
Aluminum filler wire for consumable electrode will be featured along with other aluminum forms.
**Circle No. 59 on Reader Service Card.**

**AMERICAN MANGANESE STEEL DIV.** ..... 257-258-259
MF magnetic flux welder will

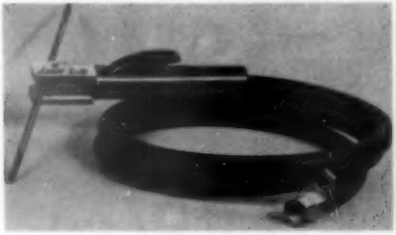
be demonstrated. Large automatic 550 unit will be introduced.
**Circle No. 50 on Reader Service Card.**

**AMERICAN PLATINUM WORKS** ..... 133-134
Silver brazing alloys for a variety of applications are featured.
**Circle No. 27 on Reader Service Card.**

**AMERICAN WHEELABRATOR & EQUIPMENT CORP.** ..... 104
Demonstrations will feature abrasive blast cleaning process.
**Circle No. 192 on Reader Service Card.**

**AMPOWER PRODUCTS CO.** ..... 118
Portable spot welder with electronic timing control will be featured.
**Circle No. 189 on Reader Service Card.**

**ARCAIR COMPANY** ..... 123
Carbon-arc-air cutting and gouging torch burners' aid kit



for manual flame cutting will be featured.

**Circle No. 30 on Reader Service Card.**

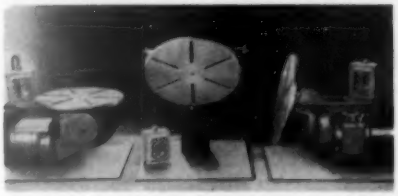
**ARCOS CORP. .....279-280**
Aluminum welding wire for every application, submerged arc fluxes for welding stainless steel will be featured along with "weld insert" process for pipe welding.

**Circle No. 193 on Reader Service Card.**

**ARO SPOT WELDERS, INC. .....276**
Air and water cooled spot welders will be shown.

**Circle No. 194 on Reader Service Card.**

**ARONSON MACHINE CO. ....120-121**
Complete display of welding positioners and turning rolls will feature new Model WPR



pipe rolls and new Model D welding positioner.

**Circle No. 176 on Reader Service Card.**

**ATLAS WELDING ACCESSORIES ..122**
Display will feature complete line of weld cleaning tools and accessories.

**Circle No. 195 on Reader Service Card.**

**Booth No.**

**BAY STATE ABRASIVE PRODUCTS CO. .....214-215**
Blue Flash "BF" raised hub disc-wheel for portable grinding tools will be highlight of abrasive products display.

**Circle No. 22 on Reader Service Card.**

**BERNARD WELDING EQUIPMENT CO. .....229**
Automatic and semi-automatic equipment for use with new "slag-gas" shielded arc welding of mild steel is featured.

**Circle No. 196 on Reader Service Card.**

**BURDETT OXYGEN CO. (and AMERICAN INDUSTRIAL SAFETY EQUIPMENT CO.) .....130**
Portable flame cutting unit,

Burdox Beaver will be featured.

**Circle No. 197 on Reader Service Card.**

**CAM-LOK DIV., EMPIRE PRODUCTS, INC. .....126**
Two new "quick-disconnect" electrode holders that feature

built-in cable connectors will be featured.

**Circle No. 198 on Reader Service Card.**

# These Companies Help You Solve

**CAYUGA MACHINE & FABRICATING CO., INC. .....267**

Automatic welding with pedestal-and seamer-type welding units and with precision weld positioners is featured.

**Circle No. 178 on Reader Service Card.**

**CHAMPION RIVET CO. .....273**
New chrome-moly welding electrodes will be among complete line of electrodes on display.

**Circle No. 199 on Reader Service Card.**

**CONTOUR MARKER CORP. ..223-224**
Display of layout tools for pipe welding, radius markers and centering heads.

**Circle No. 28 on Reader Service Card.**

**COYNE CYLINDER CO. .....207**
Acetylene cylinders with curled-under protective shield in

capacities to 320 cubic feet are featured.

**Circle No. 20 on Reader Service Card.**

**CRUCIBLE STEEL CO. OF AMERICA .....246 to 249**
Complete line of stainless steel

welding electrodes and wire and hardsurfacing electrodes will be featured.

**Circle No. 24 on Reader Service Card.**

**DOCKSON CORP. .....251**
Protective devices for welding operators and complete line of

oxy-acetylene welding equipment will be shown.

**Circle No. 23 on Reader Service Card.**

**EUTECTIC WELDING ALLOYS CORP. .....243-244**
Five new copper alloys for gas and arc welding and five new fluxes for silver brazing will be featured. Electrode for joining nickel and nickel alloys will be introduced.

**Circle No. 200 on Reader Service Card.**

**FROMMELT INDUSTRIES .....106**
Safety shields and welding curtains will be displayed.

**Circle No. 41 on Reader Service Card.**

# Your Welding and Cutting Problems

**FIBRE-METAL PRODUCTS CO. ....145**

Live demonstration will feature Weld - Prober machine for removing weld specimens. Displayed will be complete line of welding helmets.

**Circle No. 201 on Reader Service Card.**

**GAMMA INDUSTRIES, INC. .....206**
Equipment for radiographing dense materials using radioactive isotopes will be displayed.

**Circle No. 202 on Reader Service Card.**

**GENERAL ELECTRIC CO. ..264 to 266**
A new 295 amp A-C welder, a new 200 Amp engine driven

welder, Fillerarc welding and a new E7010 electrode will all be introduced.

**Circle No. 203 on Reader Service Card.**

**GOLDSMITH BROS. SMELTING & REFINING COMPANY .....131**
Complete line of silver brazing alloys and fluxes will be shown.

**Circle No. 86 on Reader Service Card.**

**HANDY & HARMON .....Unassigned**
Practical demonstrations highlight silver brazing — both manual and automatic.

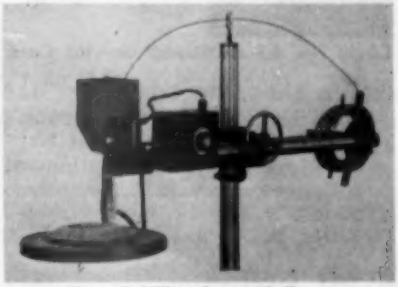
**Circle No. 80 on Reader Service Card.**

**HARNISCHFEGER CORP. .....252-253**
New WP-1, a bench model welding positioner for smaller fab-

rications will be introduced. Complete line of welding machines and electrodes will be on display.

**Circle No. 204 on Reader Service Card.**

**HOBART BROS. COMPANY ..268-269**
Automatic welding head designed for use with constant voltage arc welder is featured. "Mig-



arc" and "Handomatic" processes will be demonstrated. Complete line of welders and electrodes will be displayed.

**Circle No. 205 on Reader Service Card.**

**INDUSTRY & WELDING..... .....144**

**INTERNATIONAL NICKEL CO., INC. .....109 to 114**
Multi-purpose electrode, Inco-Rod A, for joining dissimilar metals will be introduced.

**Circle No. 206 on Reader Service Card.**

## See these exhibits too . . .

**JACKSON PRODUCTS** ..... Booth No. 143
Display of electrode holders and welding helmets.
**Circle No. 1 on Reader Service Card.**

**KASSON DIE & MOTOR CORP.** ....116
Portable 200 amp AC welder, which weighs only 65 lbs., will be displayed.
**Circle No. 66 on Reader Service Card.**

**K S M PRODUCTS, INC.** .....136
Operating demonstrations of stud welding equipment and accessories.
**Circle No. 207 on Reader Service Card.**

**LINCOLN ELECTRIC CO.** ....239-241

New, universal combination arc welder, Idealarc, which provides choice of AC or DC welding current will be exhibited for first time.
**Circle No. 63 on Reader Service Card.**

**LIQUID CARBONIC CORP.** .....125
New developments in company's complete line of arc and oxy-acetylene welding equipment and accessories will be introduced.
**Circle No. 208 on Reader Service Card.**

**MCKAY COMPANY** .....235
AC-DC welding electrode and low hydrogen-type hard surfacing electrodes will be featured along with complete line of mild, low alloy and stainless steel electrodes and wire.
**Circle No. 209 on Reader Service Card.**

**MAGNAFLUX CORP.** .....139
Demonstration of various nondestructive testing methods.
**Circle No. 210 on Reader Service Card.**

**MARQUETTE MANUFACTURING CO.** ..... Booth No. 213
New electrode for welding cast irons and four models of an oxy-acetylene torch will be featured.
**Circle No. 165 on Reader Service Card.**

**METAL & THERMIT CORP.** ..250-251
New chromium - molybdenum electrodes, which require minimum of preheat and postheat

treatment, are introduced. Complete line of arc welding electrodes, machines and accessories will be shown.
**Circle No. 78 on Reader Service Card.**

**MILLER ELECTRIC MFG. CO.** .....256-258
Complete line of arc welding machines, including DC rectifiers, inert arc welders and portable gas engine-driven units, will be featured.
**Circle No. 49 on Reader Service Card.**

**MODERN ENGINEERING CO.** .....203
New oxy-acetylene and carbon dioxide regulators and improved flint lighter will be introduced.
**Circle No. 212 on Reader Service Card.**

**MOEHLENPAH ENGINEERING CO.** .....278

**NATIONAL CYLINDER GAS CO.** .....260-263
Iron powder electrodes, complete line of equipment for arc and oxy-acetylene welding and welding fittings and flanges will be featured.
**Circle No. 213 on Reader Service Card.**

*(Turn to Page 114)*

# You'll want to see—

*the latest in...*

**HELIARC WELDING**
**SIGMA WELDING**
**UNIONMELT WELDING**
**AUTOMATIC TRACER-GUIDED MACHINE CUTTING**

## *Visit the* LINDE *display at the 1955 Welding Show in Kansas City, Missouri, June 8, 9, and 10*

Whether your fabricating needs are for a small shop or for huge production lines—on carbon steel, complex alloys, or non-ferrous materials — LINDE has a high-speed, cost-saving electric welding process for every job...And if your problem is precision cutting of sheet or plate materials – LINDE oxy-acetylene cutting machines may be the answer. LINDE *representatives* will be glad to answer your questions and demonstrate or explain the finest in metal fabricating and cutting.

*Be sure to see all demonstrations* — straight polarity sigma welding of carbon steel plate, HELIARC welding of pipe, and shape-cutting with an automatic tracer.

Make a note to visit the LINDE display —space number 218.

**Linde Air Products Company**
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
Offices in Other Principal Cities

In Canada: DOMINION OXYGEN COMPANY
Division of Union Carbide Canada Limited, Toronto

*The terms "Linde," "Heliarc," and "Unionmelt" are registered trade-marks of Union Carbide and Carbon Corporation.*

Linde Trade-Mark

**Circle No. 79 on Reader Service Card.**

# Tempilstik°

**FOR ALL HEAT-DEPENDENT OPERATIONS**

*looks like a crayon...*
*marks like a crayon...*
*tells temperatures like a precision instrument!*

Sixty-three different compositions enable you to determine and control working temperatures from 113° to 2000° F. TEMPILSTIK° marks on workpiece "say when" by melting at stated temperatures—plus or minus 1%.

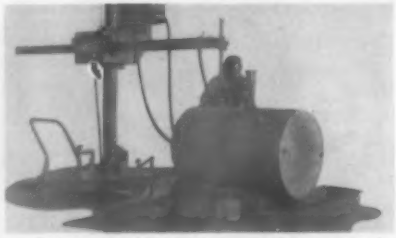
ALSO AVAILABLE IN LIQUID AND PELLET FORM... WRITE **SALES DEPT.** FOR SAMPLE TEMPIL° PELLETS... STATE TEMPERATURES OF INTEREST—PLEASE!

**Tempil°**
**CORPORATION**
132 WEST 22ND STREET
NEW YORK 11, N. Y.

**Visit our Booth #216**
**Welding & Allied Industries Exhibit**
**Kansas City, June 8-10**
**Circle No. 64 on Reader Service Card.**


**NATIONAL TORCH TIP CO. .....274**
Display of oxy-acetylene welding and cutting tips.
**Circle No. 214 on Reader Service Card.**

**PANDJIRIS WELDMENT CO. .....245**
Continuous fully automatic welding with positioner, turning roll and welding head manipulator performing 19 separate and automatic movements will be featured.



**Circle No. 215 on Reader Service Card.**

**PAGE STEEL & WIRE DIVISION ....142**
Complete line of stainless steel electrodes, welding rods and wires will be on display.
**Circle No. 17 on Reader Service Card.**

**C. E. PHILLIPS & CO. .....107**
Complete line of arc welding electrodes for repair and fabrication of cast iron parts will be demonstrated.
**Circle No. 216 on Reader Service Card.**

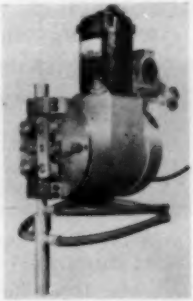
**PORTER-CABLE MACHINE CO. ....209**
New portable electric metal-cutting band saw will be introduced.
**Circle No. 217 on Reader Service Card.**

**PROGRESSIVE WELDER SALES CO. .....281**
**Circle No. 218 on Reader Service Card.**

**PURITAN COMPRESSED GAS CORP. .....137**

**J. M. RAGLE INDUSTRIES .....135**
Displays and demonstration of white metal welding and brazing alloys; arc welding and oxy-acetylene welding accessories.
**Circle No. 219 on Reader Service Card.**

**REID-AVERY CO., INC.** .....275



New welding head for automatic submerged arc and inert arc welding will be introduced. Low hydrogen-type contact electrodes will be featured.

**Circle No. 164 on Reader Service Card.**

**RESISTANCE WELDER MANUFACTURERS ASSN.** .....146

Welded products made by resistance welding will be featured. Literature covering all phases of the process is available.

**ROBOTRON CORPORATION** .....277

Synchronous controls for welding aluminum, as well as non-synchronous controls will be featured.

**Circle No. 220 on Reader Service Card.**

**SELLSTROM MFG. CO.** .....211

Complete line of protective equipment and safety clothing and accessories will be featured.

**Circle No. 221 on Reader Service Card.**

**A. O. SMITH CORP.** .....256-257

C-Omatic process which uses carbon dioxide as a shielding gas for inert arc welding will be featured. Complete line of arc welding electrodes and machines will be featured.

**Circle No. 52 on Reader Service Card.**

**SMITH WELDING EQUIPMENT CO.** .....242

Complete line of oxy-acetylene welding and cutting equipment is displayed.

**Circle No. 129 on Reader Service Card.**


# Improve

## Positioning and Lifting Efficiency . . .

*at low cost!*

**Safely lift and position weldments of all types and sizes. Rugged, lightweight Gonser Positioners provide versatile low cost handling.**

*Heavy 8" weldment easily lifted and positioned with this unit.*

**The most economical welding positioner ever developed. Safely, easily and quickly handles and positions plate and shapes of all kinds.**

*Center-type unit is used in machine shop to position castings and weldments in machines.*

**Other standard and special positioning and lifting devices available for handling weldments, castings, etc. of all sizes, shapes and forms.**

**FREE!** Write for complete details of many exclusive features.

**GONSER Portable Positioners**

**Manufactured by James Campbell Smith, Inc.**
**P. O. Box 84 • Willoughby, Ohio**

**Circle No. 65 on Reader Service Card.**

**SQUARE D. COMPANY** .....212
Synchronous precision electronic control for single phase resistance welding of aircraft components is introduced.

**Circle No. 223 on Reader Service Card.**

**STOODY COMPANY** .....169-172
Fabricated tubular wires of 7/64-inch diameter containing alloys for application by semi-automatic process will be demonstrated using machines converted to accommodate the wires.

**Circle No. 224 on Reader Service Card.**

**TEMPIL CORPORATION** .....216-217
Complete line of temperature indicating materials, including pellets, sticks and paints, are displayed.

**Circle No. 64 on Reader Service Card.**

**SYLVANIA ELECTRIC PRODUCTS, INC.** .....204
Three tungsten electrode types

—Zirtung, Thoriated, Tungsten and Puretung—will be shown.

**Circle No. 15 on Reader Service Card.**

**TWECO PRODUCTS CO.** .....241
Demonstrations will show how patented insulation on company's electrode holders will withstand heat and impact. Connectors, ground clamps and cable accessories will be shown.

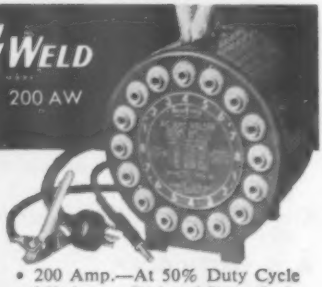
**Circle No. 225 on Reader Service Card.**

**UNIFLEX CABLE DIVISION, UNITED METAL CRAFT CO.** .....115


FIRST TRULY PORTABLE 200 AMP. ARC WELDER

*Weighs only 65 lbs.; carry it to the job!*
*Using the first TOROIDAL transformer!*

BREN-WELD MODEL 200 AW



OBSOLETES ALL OTHER WELDERS OF COMPARABLE RATING!

Employing the first toroidal transformer ever used in arc welders, the portable Bren-Weld does the work of conventional welders 4 to 5 times its size and weight. Eliminates the necessity to transport bulky equipment or heavy parts to be welded.

Bren-Weld handles electrodes from 3/64" through 5/32"; it has adjustable arc voltage for various arc characteristics.

Because it is so flexible in operation and application, Bren-Weld is ideal for plant production and maintenance, for construction work, for railroads, on the farm and in home workshop.

- 200 Amp.—At 50% Duty Cycle
- 250 Amp.—Reduced Duty Cycle
- 110/220 Volts A.C., 50/60 Cycles
- *Also Available For 220/440 Volts*
- Fully Guaranteed

11" x 12" x 7½" LIST PRICE F.O.B., L. I. City $169.50
Lowest Price On Market For Comparable Ampere Rating

24 HOUR DELIVERY FROM STOCK!

**FREE!** For details of free trial offer and folder see your dealer or write directly.

Manufactured by BRENNEN, BUCCI & WEBER, INC. New York City

Sales Division
KASSON DIE & MOTOR CORPORATION
INTEGRITY SINCE 1919
32-14 Northern Boulevard, L. I. City 1, N. Y.

A KASSON PRODUCT

**Circle No. 66 on Reader Service Card.**

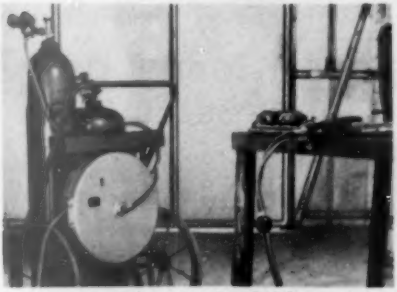
**UNION CARBIDE & CARBON CORP. .....218 to 222, 230 to 232**

Everything for arc, inert arc, submerged arc and oxy-acetylene welding will be featured by divisions of the corporation.

**Circle No. 227 on Reader Service Card.**

**UNITED SPECIALTY CORP. .....141**

Reels for handling dual welding



hose are featured. Cable reel for arc welding cable is introduced.

**Circle No. 100 on Reader Service Card.**

**UNITED WIRE & SUPPLY CORP. ..117**

Display will feature brazing alloys, typical and not so typical assemblies made by brazing.

**Circle No. 60 on Reader Service Card.**

**VELOCITY POWER TOOL CO. .....128**

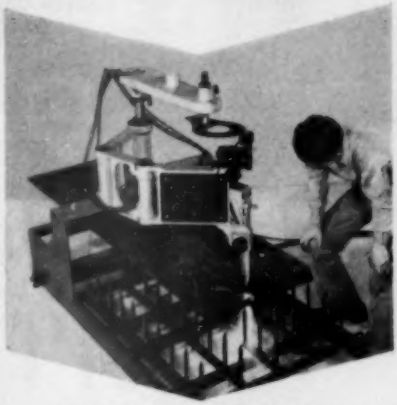
Air-acetylene and air-propane Torchomatic gas guns will be

featured along with power driver for installing fasteners in steel or concrete.

**Circle No. 43 on Reader Service Card.**

*(Continued on Page 164)*


# It's Tops



**FOR SOLVING FLAME CUTTING PROBLEMS**

**Small or large—OHMSTEDE's time and labor saving equipment provides faster, easier cutting at lower costs.**

**Here are 8 big reasons why OHMSTEDE is your best buy.**

- Unlimited variety of shapes
- Wide cutting range—cuts 42" dia circle and straight line of 89"
- Spindle and automatic magnetic tracing
- Operates on either alternating or direct current
- Delivered with base—no extras required
- Sealed ball bearing construction
- Enclosed motor
- Low initial cost—high efficiency

OHMSTEDE flame cutting machines are the end-result of many years of development. Ruggedly constructed, they give trouble-free service and unexcelled performance under all conditions of use.

*Write for complete details*

Ohmstede
MACHINE WORKS
897-899 N. MAIN ST. • BEAUMONT, TEXAS

**Circle No. 67 on Reader Service Card.**

NCG Torchweld® torches for Ferrojet cutting are available in models for either machine or hand cutting. Illustration shows the Ferrojet machine cutting torch adapted to the NCG Cut-O-Matic® portable cutting machine.

Riser pads on this stainless steel casting are being removed in half the time with the Ferrojet flame washing torch. It may also be used for removing cracks, chill bars, fins and sand inclusions from stainless and high alloy castings.

# NCG FERROJET® Dispenser teams up with

# CUT POWDER-CUTTING

Mounted on a standard, two-wheel gas cylinder truck, the dispenser plus a cylinder of either compressed air or Nyrogen® make a mobile, easy-to-handle outfit. Dispenser does not require electricity . . . can be operated anywhere.

**NCG Ferrojet Dispenser costs up to 70% less than expensive makes . . . gives unsurpassed performance**

If it were possible for you to compare all the various powder dispensers, right in your own shop, on your own work, you would probably choose the NCG Ferrojet Dispenser. Here's why:

You save up to $600 on each dispenser you buy, because NCG's simplified dispensing principle provides a uniform flow of powder without using a complicated powder feeding mechanism. But low price is only half of the story.

Even more important than initial savings is its outstanding performance. For no other dispenser, regardless of cost, is capable of delivering more precise or uniform flow of powder. (And uniform flow, of course, is the basis of successful powder cutting.) No other dispenser is as easy to operate and maintain.

## CHOICE OF TWO MODELS

In the automatic Model 301 Ferrojet Dispenser, gas pressures and amount of powder flow are maintained automatically. Special powder control operates simultaneously with turning-on and shutting-off of cutting oxygen valve on torch. Powder flow must be turned off manually on semi-automatic Model 302 Ferrojet Dispenser.

**Circle No. 68 on Reader Service Card.**

Ferrojet equipment is readily adaptable to machine cutting operations. Here a large diameter is being Ferrojet-cut from a 5½" thick plate by one of the country's large producers of cut-to-order stainless steel shapes.

# new type powder to COSTS...

The Ferrojet hand cutting torch, shown cutting risers from a heavy, stainless steel casting, is widely used in foundries, fabricating plants and in scrapping operations. Tips are available for Ferrojet-cutting up to 16" thicknesses in steel.

## Amazing new NCG Ferroflame® Powder speeds cutting and washing, reduces powder consumption

Unlike ordinary ferrous powders that are made up of solid, relatively thick particles, the revolutionary new NCG Ferroflame powder consists of tiny spheres crushed into extremely thin flakes.

The greater surface area of these flakes, as contrasted to solid particles, makes Ferroflame powder burn much more rapidly and with a higher concentration of heat. This means faster, easier cutting and reduced powder consumption.

NCG Ferroflame powder is available in two types: Type A for general purpose cutting, and Type B for washing operations. Both types packed in air-tight 100-lb. containers.

NCG®

EVERYTHING FOR WELDING

Copyright 1954, National Cylinder Gas Company

**NATIONAL CYLINDER GAS COMPANY • 840 N. Michigan Ave., Chicago 11, Illinois**

*Branches and Dealers from Coast to Coast*

## EVERYTHING FOR POWDER-CUTTING FROM ONE SOURCE!

You get all four with NCG—equipment, gases, powder and skilled technical assistance. Find out more about this complete powder-cutting service. Phone or write your nearest NCG representative or dealer, or write for information.

**Circle No. 68 on Reader Service Card.**

# 23 Welding Supply Distributors

## *look into the future of welding*

MARKING the 10th anniversary of the founding of the N.W.S.A, INDUSTRY & WELDING Magazine asked distributors to predict what changes would take place in their industry in the next 10 years. What they saw in their crystal balls is told here. Are they right?

### Ten Percent Yearly Increase

"It is my opinion that demand for welding and welding equipment will increase at an average rate of 10 percent per year over the next 10 years. There will be continued trends towards automatic and semi-automatic welding creating great demand for high frequency AC, AC-DC and rectifier-type welders. Demands for resistance welding equipment will also increase at same rate."

*George Pennington*
*Manufacturers Agent*
*Los Angeles, California*

### Distributors Will Diversify

"During the next ten years, gas manufacturers will do all they can to relieve themselves of the burden of cylinder investments. This will mean elimination of small scattered welding supply distributor who is now no more than a trucking service for the manufacturer. It will mean that, except in a larger city, a welding supply distributor will have to diversify."

*H. L. Bradley, President*
*Bradley Industrial Supply Co.*
*Borger, Texas*

### Increased Resistance Welding

"Resistance welding coupled with special designs and associate tooling has a tremendous future. Manually operated welding equipment will fade out gradually and be replaced by air or hydraulic machines coupled with automatic controls. The special purpose welder will become more prominent even in smaller shops as production costs become increasingly important. We look forward to the development of atomic power to help generation of electrical power."

*P. Arthur Green, Secretary*
*Robert W. Hoffman Co., Inc.*
*Chicago, Ill.*

### Use More Rectifier Welders

We have not yet tapped about 75 percent of the available business. Dollar volume of the distributors should steadily rise in next decade. Rectifiers will probably almost entirely replace the motor-generator type of DC arc welder in 300 amp and larger sizes.

*Al Earlbeck, President*
*Earlbeck & Landrum, Inc.*
*Baltimore, Md.*

### Must Stop Price Cutting

"My frank opinion is that unless the distributors quit cutting prices, which creates no business, and manufacturers provide an equitable arrangement for the distribution of their product and stick to it, the welding supply distributor is in for a bleak future."

*J. M. Robinson, President*
*Robinson Welding Supply Co.*
*Detroit, Michigan*

### Swing to Automatic Welding

"I can see a swing to automatic arc welding using positioners and fixtures. The dollar volume may be affected by the fact that more automatic welding will increase dollar sales for distributors. A new development that I would like to see is a light-weight cylinder for oxygen or acetylene."

*Ogden C. Mills*
*Mills Welding Supply, Inc.*
*Buffalo 9, N. Y.*

### Welding Demands Skyrocket

"In this area we are on the brink of new industrial developments that will skyrocket welding demands beyond all expectations. New processes and products will tax our ability to service our customers' needs and requirements."

*Reid Jones, Jr.*
*Jones Welding Supplies*
*Roanoke, Virginia*

### Improved Welding Equipment

"Automatic welding process will be improved and costs lowered; inert arc welding will show largest gains; temperatures in excess of those now available to the welding industry will be created by atomic fission and may have certain advantages over other heat sources. All welding equipment will become lighter, less bulky, smoother operating and relatively lower in cost."

*Lee G. Helder, Owner*
*General Welding Equipment Co.*
*Cincinnati, Ohio*

### Operators to Be Specialists

"Anything that can be done automatically will be done that way. The operator will become a specialist. Our welding engineers today will be the 'whitecoated' supervisors of tomorrow. They will supervise equipment doing the same job as many semi-skilled welding operators of today."

*Bob Farr*
*Welding Sales & Engineering Co.*
*Detroit, Michigan*

### High Cost of Shipping

"Consistent growth of welding is assured, but thought should be given to the profit aspect. In recent years profit picture has been affected by high cost of shipping. Distributors have been selling many items at factory published prices and absorbing the shipping charges. What was formerly a profit sacrifice of one to three percent, now runs from five to ten percent."

*John C. Owen*
*Owen Welding Supply*
*Chicago, Illinois*

# Welding Distributors Take a Look at the Future

### Atomic Powered Welding

"Large industrial plants will have central welding power supply furnished by atomic power; plug-ins will be available throughout the plant. Production welding will be 90 percent automatic.

Portable arc welders will be half the weight and size and amperage will be doubled. A-C gas-driven welders will be used on most residential building jobs.

Inert gas field should be 30 times as great as it is now; most job and auto body shops will use inert arc process on alloy and plastic car bodies.

Yearly income of employed will be increased 50 percent and we will have 32-hour work week, with general holiday on Wednesdays."

*James N. Alcock*
*Saginaw Welding Supply Co.*
*Saginaw, Mich.*

### Some Must Make A Choice

"Some may have to choose between following the technical field as it advances or staying with the existing retail or small user field where progress and distribution costs are going ahead and up more rapidly. Technical side requires sales personnel on a higher plane and salary. Sales must be developed over a longer approach and continuously serviced after a successful close. These also reduce the retail or standard volume and the following business dollar volume is not always there. Technical equipment is not a package item and the gross profit is most commensurate with the sales cost."

*Bob McCracken*
*R. S. McCracken and Sons*
*Philadelphia, Pa.*

### Things Could Be Tough

"Biggest problem is getting the industry to be distributor minded. The next few years will be tough on distributors because some manufacturers are mostly selling direct and show interest in only small dealers."

*Bob Kohlbry*
*Machinery and Welder Corp.*
*Chicago, Ill.*

### Future Looks Very Bright

"From a welding distributor's standpoint the future looks extremely bright. Growth in volume and dollars will be sales to service shops of all types, hobbyists and the "do-it-yourself" customer. The welding distributor must continue to improve his operations, service, promotion, product knowledge, marketing methods, facilities in the next ten years."

*Tom Middleton*
*Middleton Welders Supply Co.*
*San Leandro, California*

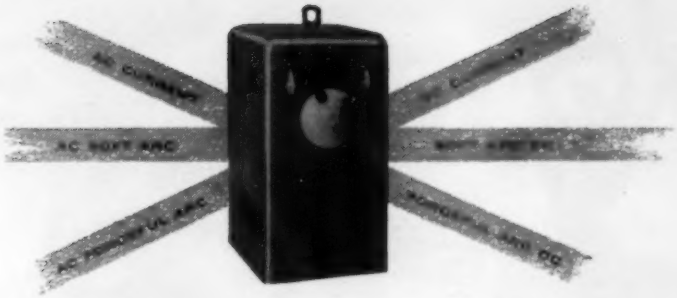
### Use of Metals to Double

"The use of metals is increasing and in the next ten years should almost double. A factor that is not good is the poor showing profitwise of electrodes and welding machines."

*Lewis Goldberg*
*Altoona Welding Supply Co.*
*Altoona, Pa.*

### Potential Is Terrific

"The potential market for welding in years to come is terrific. The constant voltage machines coupled with consumable electrode inert



**Because welding costs can be cut more:**

# ALL PRODUCTION WELDING WILL EVENTUALLY BE DONE WITH "IDEALARC" TYPE WELDERS

***Shouldn't you start using Lincoln Idealarcs now?***

**FIGURE THESE FACTS:**

**1. Idealarc welding is easier, faster.** On AC welding you have the smoothest, most stable arc ever known —*plus*—choice of soft-arc and forceful arc on every job . . . to give you top speed.

**2. Idealarc handles all your jobs AC and DC.** You can standardize on one machine for all production welding. You can buy Idealarc as an AC-DC machine . . . or as a straight AC welder to which a DC unit can be added at any time.

**GET THE WHOLE STORY**—Write for Bulletin 1343

## THE LINCOLN ELECTRIC COMPANY

Dept. 1805 — Cleveland 17, Ohio

*The World's Largest Manufacturer of Arc Welding Equipment*

**Circle No. 63 on Reader Service Card.**

# New, ready-to-use "132" Inconel Electrodes

**X-ray quality welds** — you can use the new Inco "132" Inconel Electrodes right from the container. And get X-ray quality corrosion resisting welds.

**No rebake is needed** because "132" Inconel Electrodes have a new durable flux coating and new core wire. They give strong, sound weld deposits that meet all approved specifications for Inconel... and Incoloy, too.

**High rate of deposition,** smooth bead contour, stable arc in all positions, and easy slag removal are other advantages you get with the new "132". (Recommended for D.C. welding, reverse polarity.)

**Come in standard sizes**—14-inch lengths in 5 diameters: 5/64- and 3/32-inch (center grip)... or 1/8-, 5/32-, and 3/16-inch (end grip).

Your local Inco distributor has the new "132" Inconel Electrode in stock. Order a 5-lb. package today. You'll like the protective tubular container. It has asphalt lining, metal ends and moisture-resistant, sealing tape.

INCO TRADE MARK **Welding Products**
Electrodes • Wires • Fluxes

**Circle No. 70 on Reader Service Card.**

## "Now it's easier to weld Inconel than ever before"

I saw them testing the new "132" Inconel electrode the other day. And it's great!

This new flux is really tough—you can use the rods right from the package, *without any rebake!* And you still get X-ray quality welds.

The weldor who was making these tests liked the smooth arc and easy handling of the new "132" electrodes. And 20 minutes after he finished, I saw the X-ray negatives. They would pass any code requirements!

You just try the new Inco "132"® Electrode for welding Inconel® and Incoloy®. See if you don't get great results. And say, now's the time to write me for our *Welding Bulletin, T-2* — just reprinted with lots of handy new dope.

*Yours for better welds,*

Nick Rodder

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

Circle No. 70 on Reader Service Card.


arc welding, along with submerged melt, are going to revolutionize the welding industry. Mixed gases and a reduction of the cost of argon will make this welding even more attractive.

*Howard R. Montaigne*
*District Oxygen Co., Inc.*
*Brentwood, Md.*

### Market Has A Rosy Future

"Potential market could not have a more rosy future. We see a steadily increasing dollar volume of business for the industry as a whole.

*Robert White, Manager*
*Welding Supply Div.*
*Gastonia Motor Parts Co., Inc.*
*Gastonia, N. C.*

### Distributors Must Specialize

"The welding industry has just begun its march to real growth. There is no question that automatic welding will play a greater part in the future, but welding as we have known with hand torch and arc electrodes will not diminish, but rather tend to increase in usage. Automatic welding will be over and beyond this. Whereas the specialty welding supply house came into its own in the past ten years, the next ten will see specialty houses within specialty houses as the use of automatic welding continues to grow."

*William A. Rice, President*
*Virginia Welding Supply Co.*
*Charlestown, W. Va.*

### Changed Distribution Patterns

"I believe the use of welding torches will be practically eliminated and replacing in large operations by electric, atomic or some other heat producing element. The use of cutting by gases will be practically eliminated.

The present day small welding supply jobber will be practically

## "Swing To More Automatic

eliminated by the large manufacturer or welding apparatus dealer setup. Instead of having, for instance, in the city of Baltimore, approximately 12 distributors of welding apparatus and supplies there will be possibly four. Large manufacturers of electrodes will direct to the consumers.

I don't believe any of the small jobbers who purchase and resell oxygen and acetylene will be able to survive on the small volume and profit they receive on the sale of gases. This business will be handled by the manufacturers of these gases. They will control the apparatus business as they sell these gases.

*S. C. Trippe, Jr., Pres.*
*Trippe Supply Co.*
*Baltimore, Md.*

### Modernization of Equipment

"We find many shops are also thinking in terms of modernizing their shops with automatic welding, turning rolls and positioners; all of which indicates that sales will be larger in volume; however, the margin of profit is suffering a decline."

*Howard Proctor, Pres.*
*Acme Welding Supply, Inc.*
*Houston, Texas.*

### Demonstrate to Sell

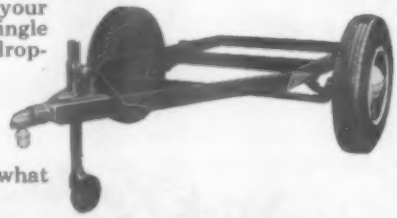
Future is rosy for the house that has a complete line of cutting and welding equipment, as a department in a large corporation or a corporation that specializes and has men that are capable of using welding or cutting torch; however, a mill supply house that has a department that does not have specialty men, will never make any real money.

*Edward F. Stauss*
*Stauss & Hass, Inc.*
*New Orleans, La.*

**CASH IN ON TRAILERS**

*built with Hammer Blow "ready-to-go" running gear!*

Build the sport and work trailers your customers want — with Hammer Blow Multi-Purpose Undercarriages. Welded steel channel frames, to your specifications, fitted with standard single or tandem axle, wheeled jack and drop-forged coupler. Capacities to 10,000 lbs. We can also supply component parts in any combination, for assembly in your shop. Over 30 years in business, so our stuff is *good!* Write and tell us what you need!



**HAMMER BLOW TOOL COMPANY**

WAUSAU 18-F, WISCONSIN

Circle No. 71 on Reader Service Card.

## Welding Indicated."

### Increased Distributor Importance

"Each succeeding year will find the welding supply distributor playing a more and more important part in the economy of the Industry. The past 10 years have seen tremendous improvements in the quality of the welding distributor. Today they are in a position to employ men who have a far-reaching knowledge of the problems of the industry and are accepted as the best and most complete source of information.

The dollar volume among distributors will show the same or faster rate of growth in years to come as manufacturers more than ever realize the economy of distribution through the jobber.

The use of automatic equipment will be more and more accepted. This applies to submerged arc and inert arc welding."

*G. M. Sims*
*Absco Welding Equipment & Supplies*
*Los Angeles, Calif.*

### More Than An Order Taker

"Demand for technical service has been but scratched in the past. Future requirements of a distributor will almost place him in an engineering category. To service this important field in industry, he will have to extend himself beyond the station of an order taker.

Educating the industry by conveying the suppliers' technical information is a prerequisite for the future.

Concentration of efforts in behalf of a given area and specific merchandise, rather than an extended effort in the category of a merchandiser of welding and hardware lines will be the order of the future."

*S. A. Zane*
*Zane WeldCraft Supplies*
*Hartford, Conn.*

THIS IS
BASIC
The bitterness of poor quality lingers long after the sweetness of low price is forgotten.
It is to your best interest never to forget that there is no Santa Claus in the RESISTANCE WELDING ELECTRODE business.
Whenever price is CUT, quality is CUT! The reasons given you for price cutting are those the price cutter wants you to hear. That is the time to beware, because substitutions can be made in tip manufacture that cut cost and quality, yet are not apparent in the finished product until it is used.
No one can do business long without a profit. When a tip price is CUT, something is taken out. That something is QUALITY . . . and its loss will be in proportion to the price cut. If you buy cut-price tips, expect to get cut-quality tips. It is basic that you never get more than you pay for.
You EXPECT more from TIPALOY and you GET more! TIPALOY electrodes cost more, but for a slightly higher initial cost these are your major gains:
1. 30% to 100% longer electrode life!
2. Less down-time and maintenance!
3. More welds per electrode!
Write for the story of Tipaloy today!
Distributor franchises available!
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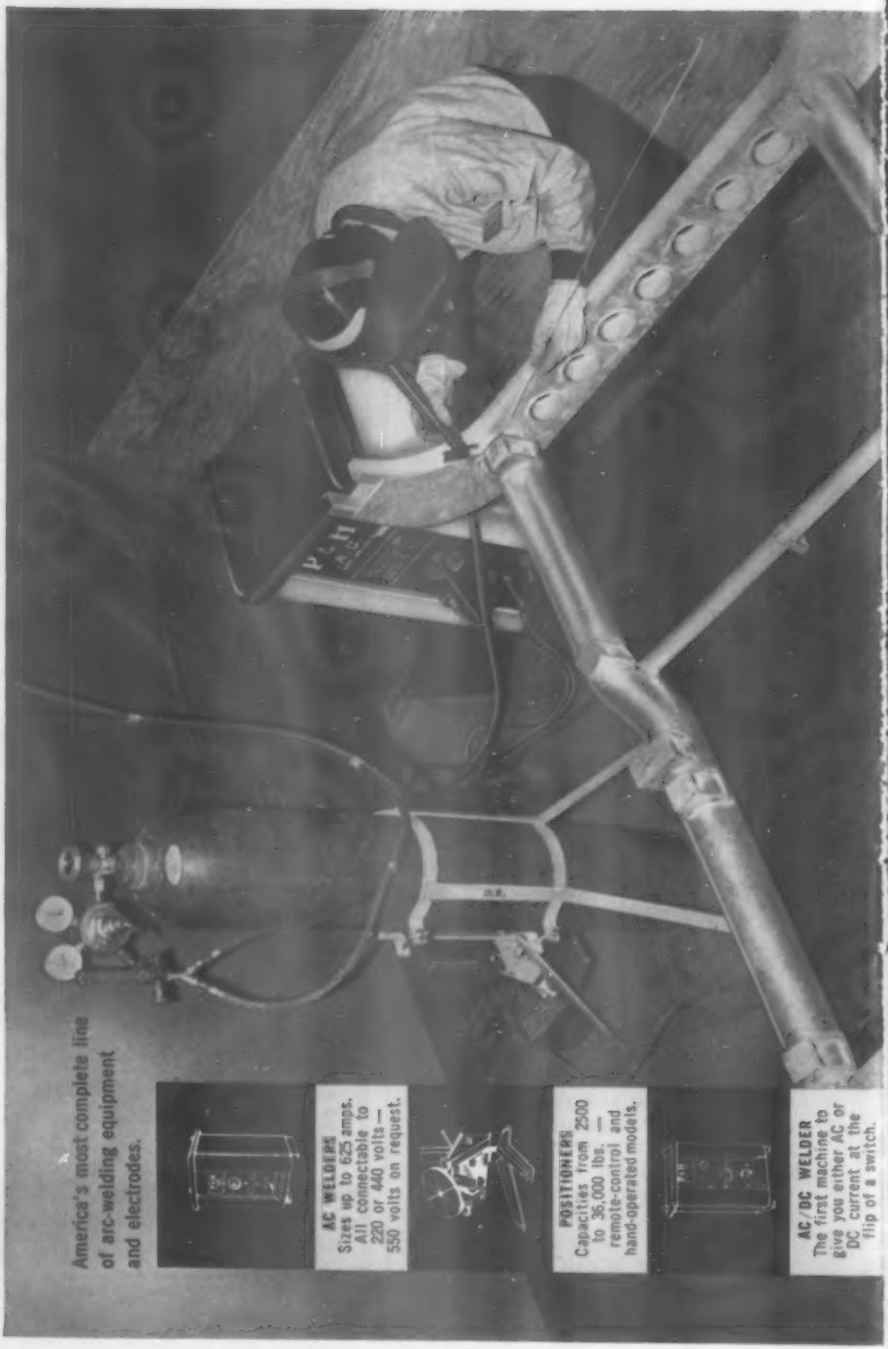
America's most complete line of arc-welding equipment and electrodes.
AC WELDERS
Sizes up to 625 amps. All connectable to 220 or 440 volts — 550 volts on request.
POSITIONERS
Capacities from 2500 to 36,000 lbs. — remote-control and hand-operated models.
AC/DC WELDER
The first machine to give you either AC or DC current at the flip of a switch.

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DC RECTIFIER WELDER
Four sizes—200, 300, 400, and 500 amps.

Fabricating aluminum camera mount at Douglas Aircraft with P&H high-frequency A C machine.

ELECTRODES
For mild steel, cast iron, "hard-to-weld" steels, stainless steels, hard surfacing.

# Douglas Aircraft improves weld quality, increases production, speeds operator training

*... thanks to the ease of operation and simplified control of P&H Dial-electric Arc Welders*

TALK to Douglas Aircraft engineers at Santa Monica about welding thin sections of aluminum, stainless steel, and titanium. They'll tell you that complete control of the welding arc is of the utmost importance. That's why they've switched to P&H Welders for all their inert-gas, shielded-arc operations.

It's easy to see why Douglas is sold on P&H. It's the only welder that provides precise heat regulation and high-frequency stabilization positively and instantly with an automobile-accelerator type of foot control. Because the welder responds *immediately* to control — without time lag — production is up, spoilage is way down, and operators are easier to train. Douglas likes the reliability and steady operation of P&H Welders — they can establish control and setting standards to produce uniform welded duplication.

Try one P&H on your production line and you'll never use anything else. Get full information from your P&H representative, distributor or write us. Welding Division, Harnischfeger Corporation, 4522 W. National Avenue, Milwaukee 46, Wisconsin. 2883

# HARNISCHFEGER

the P&H Line

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**J. CARL BODE**
**President**
**National Carbide Co.**

# J. Carl Bode Heads I.A.A. for 1955-1956

ELECTED President of the International Acetylene Association at the Association's 55th annual convention at Houston, Texas, J. Carl Bode will guide the group during 1955-56. Mr. Bode is president of National Carbide Co., a division of Air Reduction Co., Inc.

Mr. Bode joined National Carbide in 1928 as superintendent of the Keokuk, Iowa, carbide plant. He was transferred to the new calcium carbide plant in Louisville, Kentucky, as works manager in 1941. In 1947, he was transferred to the company's New York offices as operating manager. He was made president of National Carbide in 1948.

Born in Keokuk in 1901, the new president of the I.A.A. graduated from the University of Wisconsin in 1923 with a degree in chemical engineering.

Mr. Bode is married and the father of one daughter.

## Association Background

One of the oldest technical associations in the country, the International Acetylene Association was organized in 1898 for the purpose of developing broader and more generally useful applications of calciumcarbide, acetylene gas and allied products.

# It's a cuttin' fool!

Light heavy-weight cutting torch *It's a* ***TRIPLE THREAT***

**NEW**

## Smith's Cutting Torch

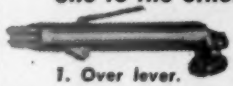
***Does the work of a heavy-duty torch but is LIGHT and easy to handle***

Cuts anything from tomato cans to 14" steel (using proper tips). Yet it is light-weight and perfectly balanced. A brute for performance but easy on the operator. We put into this torch what you and other operators asked for.

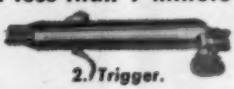
***Slip-In-Tips — no wrenches needed.***

Just slip the tip in, spin the nut with your fingers and you're ready to go. How could anything be easier? Try it yourself and see.

***3 inter-changeable controls—quick change from one to the other in less than 1 minute***



*1. Over lever.*



*2. Trigger.*

*3. Under Lever as shown at right*

No matter what type of cutting jet control you prefer, you have it in this torch—and you can switch from one to the other any time you want. Adaptable to any personal likes or techniques. Reduces number of torches needed to accommodate all operators' requirements.

***No slag . . . cuts clean.***

The new Smith Tips with this torch give you clean, knife-line cuts with narrow kerf and almost complete absence of slag. Operator does not have to waste time cleaning up his cuts. Speeds up production.

This new torch ingeniously combines more operating advantages than any you have ever seen. Trade tests to date have been sensational.

**See us in Booth 242, Am. Welding Society WELDING SHOW, Kansas City, June 8-9-10.**

**SMITH WELDING EQUIPMENT CO.**

Dept. IW-164 2633 S. E. 4th St. Minneapolis, Minn.

# Use Iron Powder Low Hydrogen Electrodes for All-Position Welding

by R. K. LEE, V.P. in Charge of Research, Alloy Rods Co.

SINCE the introduction of iron powder electrodes in this country, many claims have been made regarding this amazing electrode coating development. Strangely enough, though evidence was given to substantiate the favorable claims, no evidence was ever given to support the statements that iron powder electrodes could not be used in the vertical and overhead positions.

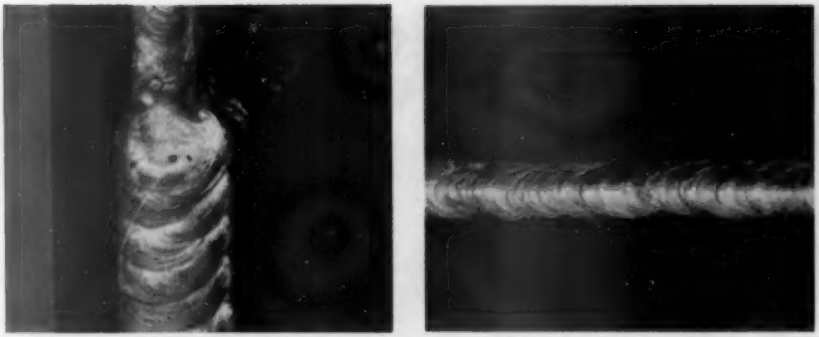
Recent developments in this field have definitely refuted hasty conclusions made by some research engineers. It can now be positively stated that low hydrogen electrodes, which have always been difficult to operate in the vertical and overhead positions, have been greatly improved and exhibit excellent usability in all positions with the addition of iron powder in their coatings.

## Conventional vs. Iron Powder Low Hydrogen Electrodes

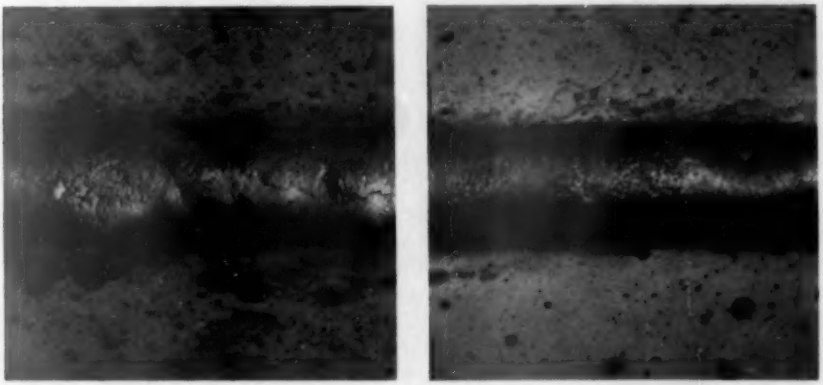
The early success of conventional low hydrogen electrodes (without iron powder) is attributable to two factors; relatively low amounts of hydrogen and basic type slag from the electrode covering. The very low hydrogen content helps to minimize underbead cracking. The basic coating provides a scavenging slag system similar to that used in basic steel melting furnaces.

Along with these valuable properties, conventional low hydrogen electrodes have several shortcomings. The electrodes are critical of welding technique in that definite short arc lengths must be held. If the arc length is too short, the arc shorts out, interrupting the weld and leaving the weld bead rough and irregular. If too long an arc is held the weld metal is porous. Spots of porosity are present throughout the bead. Striking and restriking the electrodes is troublesome in that clusters of porosity are prevalent in the starts of welds. Most conventional low hydrogen electrodes have relatively low limits as to the amount of welding current which can be used without the electrode overheating, the arc action becoming wild, spatter increasing excessively and the weld metal quality deteriorating.

The protection of conventional low hydrogen electrodes from moisture pick-up is a serious problem. Special packaging and storage facilities are required to keep the electrodes in the proper low hydrogen condition. Care must be used in the length of exposure of the electrodes to humid air while they are on the welding job. The addition of iron powder to the electrode coating does not in itself make the electrodes impervious to moisture pick-up. Development and improvement of electrode coating formulations along with the iron powder addition have resulted in resistance to moisture pick-up to the extent that safe exposure of the electrodes to the air is measured in days or weeks as compared to hours as in the case



**More effective use of welding current** assists operator in out-of-position welding. Operator had excellent control of molten metal in making vertical fillet weld (left) with $\frac{5}{32}$-inch iron powder low hydrogen electrode. Overhead fillet weld (right) made with similar electrode further illustrates control of weld metal.



**Overheating of conventional low hydrogen electrodes** can cause excessively heavy spatter. This flat bead was made with $\frac{3}{16}$-inch electrode at 260 amps, D-C, reverse polarity.

**Inclusion of iron powder** makes possible the use of higher welding currents. Notice almost complete absence of heavy spatter in this flat bead welded at 260 amps.

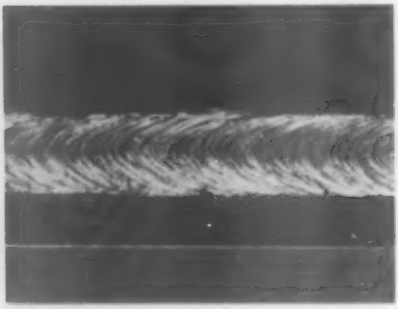
of conventional low hydrogen electrodes.

## Advantages of Iron Powder Additions

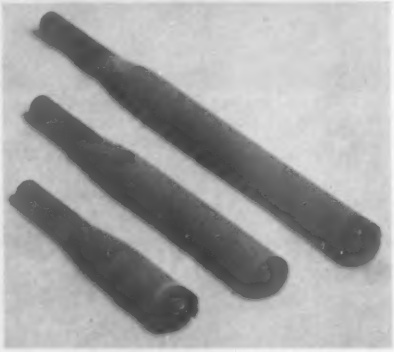
These difficulties of critical arc length and the resultant operator fatigue, starting porosity, relatively low maximum welding currents, and low resistance to moisture pick-up have resulted in greater cost of weldments and have limited the use of conventional low hydrogen electrodes.

The addition of properly balanced amounts of high quality powdered iron to the electrode cov-

**Starting porosity** is effectively eliminated by addition of iron powder to the electrode coating. Weld starts show no porosity either in striking or re-striking the arc.



**Smooth uniform horizontal fillet weld** was made with iron powder low hydrogen electrode. Drag technique was employed, using lip of coating as a guide to arc length. Resulting arc stability practically eliminated "shorting out."



**Core wires of iron powder electrodes** do not break down when electrodes are used at high currents. These stubs of $\frac{5}{32}$-inch electrodes were used in the flat position at 300 amperes.

ering has practically eliminated the shortcomings of low hydrogen electrodes. Arc length, which has been very critical, is self-adjusted by the tip of the electrode being touched to the work. The powdered iron improves stability of the arc so that it does not short out nearly so easily. This factor of eliminating the requirement of holding a definite arc length is very important in increasing both the quality and quantity of weld metal deposited per operator hour in that fatigue is greatly reduced.

Starting porosity caused by striking and restriking electrodes has been effectively removed by the addition of iron powder. When the arc is first started with a fresh electrode, the higher current, the more stable arc, and the improved fluxing action of the coating all help prevent porosity. The covering at the tip of a partially used electrode is fused into an electrically conductive condition so that the arc is very easily restruck. This feature adds to the prevention of starting porosity. The presence of iron powder in the coating of low hydrogen electrodes and the related improved welding characteristics result in uniform weld beads. This uniformity is especially noticeable in horizontal fillets. The presence of powdered iron in the electrode coating allows greater welding currents to be used without appreciably increasing the penetration. A considerable part of the increased energy from the higher welding current is con-

# Here's a *new* book YOU should have

## New Revised Edition of The Pocket Manual of Arc Welding

**Valuable Data** — the new Pocket Manual of Arc Welding contains latest welding application data of value to foremen, supervisors, inspectors and operators—in concise, easy-to-read form.

**You'll use it Every Day** — in your shop work. The new Pocket Manual of Arc Welding provides practical on-the-spot information on many arc welding problems. Written from the standpoint of welding supervisors and operators, it fills a longtime need in the industry.

**Order Your Copies Now**— Immediately available at $1.00 each. Special discounts for larger quantities. If your welding supply distributor cannot supply you, use the coupon below.

## 172 Interesting Pages

Written by Lew Gilbert, editor of INDUSTRY and WELDING this "down-to-earth" Pocket Manual can be used as a welding department guide as well as a text book for operator training programs. It contains a large variety of new reference data in the form of charts, diagrams, welding symbols, efficient joint details, etc.

The Industrial Publishing Group
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Please send me.....copies of the (POCKET MANUAL OF ARC WELDING) at $1.00 each. Check or money-order in the amount of $..... is attached.

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INDUSTRY & WELDING readers are hand-picked, carefully selected by progressive welding supply distributors—strictly on the basis of a company's welding activity and your position in the company. THAT'S FRANCHISE CIRCULATION.

***Only the BEST articles are chosen!***

The editorial staff of INDUSTRY & WELDING is headed by a nationally recognized welding authority and consists of specialists in this field. Each is chosen for his specific knowledge of one phase or another in it. It is the most qualified staff of welding people on any welding magazine.

Editorial material is carefully planned and presented to help our more than 35,000 readers do a better job at lowest possible cost.

FRANCHISE CIRCULATION

INDUSTRY & WELDING

sumed in melting the iron powder of the coating, rather than increasing the penetration of the arc. This more efficient use of the electrical energy also prevents the weld spatter from increasing as it does when conventional low hydrogen electrodes are used with high currents. At the same time, the high welding currents very effectively increase the deposition rate of weld metal.

### Less Operator Fatigue— More Efficiency

The more efficient use of the electrical energy of the welding current assists the operator in out-of-position welding. More of the energy is used in melting the iron powder of the coating rather than melting excessive amounts of the base material and super heating the weld metal. As a result, the operator has better control of the weld metal and less trouble with the molten metal running down or out of the weld joint. The improved arc stability achieved with the iron powder low hydrogen electrodes is a great advantage in out-of-position welding. The smooth arc and fine metal transfer enable the operator to make welds of which he can be proud. Higher welding currents may be used with iron powder low hydrogen electrodes in any welding position.

*(Continued on Page 158)*

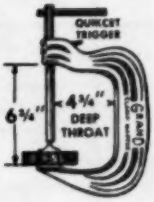

GRAND

**SPEED CLAMPS**

**A S L SERIES**

***SAVE MINUTES ON EVERY CLAMPING OPERATION!***

Grand Speed Clamps are quick setting and instant releasing—just push down the screw and tighten with a turn on the vise-type handle. Trigger releases work instantly.




Grand Speed Clamps have extra deep throats—are ruggedly built of NACO No. 6 Steel—spatter proofed.
4 Sizes: 2" to 8" Opening

**Famous GRAND "C" Clamps**

Alloy Steel (Stronger than forged) Spatter-Proofed Swivels, Deep Throat – Replaceable Swivels

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| 8 SIZES 2" TO 12" | 7 SIZES 4" TO 18" | 8 SIZES ¾" TO 12½ |

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**ARE YOU WELDING WITH NEW POWDERED IRON CONTACT ELECTRODES?**

THESE ELECTRODES MUST BE KEPT DRY. They are LOW HYDROGEN, and are undeniably susceptible to moisture. Adsorption of moisture will increase arc drive, spatter loss, undercut, and on some types, slag adherence. ARIDAIR CHEMOELECTRIC STABILIZERS are designed specifically to maintain correct moisture content of these low hydrogen electrode coatings.

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Your guide to

# LOW-COST WELD GRINDING

Reducing heavy weld with CARBOFLEX Depressed Center Wheels

| | CARBOFLEX Depressed Center Wheels | MX® Depressed Center Wheels | MX® DISCS |
|---|---|---|---|
| RECOMMENDED USES | Heavy weld Removal, Portable Cutting-off, Slotting | Light and Medium Weld and Flash Removal, Rough Blending Flat Surfaces | Light Weld and Flash Removal, Blending and Semi-finishing Flat surfaces |
| RATE OF CUT | Fast on undercutting welds, cutting off and slotting | Fast on welds and flash—medium on flat surfaces | Medium fast on light welds and flat surfaces |
| OTHER ADVANTAGES | Rigid—strongly reinforced for maximum safety | Slightly flexible—yet strong, safe. Excellent for work on soft metals and alloys | Flexible, yet rigid enough for cleaning channels, interior seams, corner welds |

...continually putting more sense in your abra[illegible]

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Grinding and finishing weld bead with PORT-A-BELT Grinding Attachment

Smoothing seam of welded aluminum casting with MX Disc

**RESIN SANDER Discs**

Light and heavy Weld Removal, Blending and Finishing contours and flats

Fast stock removal on all surfaces

Flexible—depending on sander pad used. Low cost—long life

Economical weld grinding begins when you choose the right abrasive product to do the job...from the complete line by CARBORUNDUM. Four of the most widely used types are charted here. There are many others...such as cup wheels, straight wheels, rubber-bushed wheels, PORT-A-BELT Grinding Attachments, etc. Each has its place—each does one or more weld grinding jobs faster, more economical than any other tool.

**YOUR CARBORUNDUM** Salesman or Distributor offers expert counsel, prompt delivery of the right abrasive product at the right time. Call him.

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Please send: ☐ Folder on CARBOFLEX Depressed Center Wheels
☐ Booklet on MX Abrasive Products
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☐ Information on _____

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81-57

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4 & 5-SPEED GEAR DRIVE
FLEXIBLE SHAFT MACHINES

**ONE COMPACT UNIT** cleans surface and finishes welds. Gearshift selection of 4 or 5 speeds up to 12,000 RPM lets you use one motor for several jobs . . . eliminates countershafts, drive belts and pulley changes. You change attachments with only a PRESS-PULL-SNAP action. The operator lifts only the lightweight handpiece, and can move unit easily on a wide variety of portable mountings.

**NEW CATALOG describes FULL LINE of Strand Flexible Shaft Machines, including direct drive and countershaft models with up to 3 HP; also accessories and tools. See your distributor or write direct for Catalog C-210G.**

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Woodberry, Baltimore 11, Maryland
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## HOW TO HARD SURFACE . . .

*(Continued from Page 57)*

the location and seriousness of these before he starts the job.

The die is probably in a stressed condition in spite of the relief of tensile stresses afforded by the cracks. In any case the preheat and welding temperature should be as high as can be tolerated without tempering the die and thus lowering the hardness below limits.

When repairing used tools in the hardened state, low temperature of application is more important than matching base metal hardenability; therefore, the lower melting, non-ferrous hard metals of Group III will give a satisfactory job where no other alloy will.

Where metal cutting at room temperature is involved, hardness of 58-62 RockellC is indicated. This is best achieved with a tool steel filler metal used as deposited. Metallic arc, DC, reverse polarity, skip welding and peening is recommended.

In doing this kind of a job, no condition is as important as the ability of the operator. Nothing is as critical as the correct analysis of the job by the operator and his sense of confidence and well being. No one save an equally expert die

**ABOUT THE AUTHOR**

**A Northern California metallurgist, George H. Thurston has worked with metals since his graduation from the University of California in 1936. He is now a consulting metallurgist and is also associated with W. C. Matheson Co., San Francisco.**

**Material presented here has appeared in Western Machinery and Steel World Magazine.**

**Circle No. 76 on Reader Service Card.**

welding operator should attempt to tell him what methods, techniques or material to use and such an expert will not so presume.

### Utilize Various Processes

In surfacing by oxy-acetylene welding, dilution can be minimized by backhand welding and by using an excess acetylene flame with a feather three times the length of the inner cone. The downhand position is needed for most hardfacing metal put on with this process. The right preheat and steady temperature must be maintained because excess heat increases diffusion.

Cobalt-base alloys on steel require preheat temperatures of 700-800°F typically. Deposits applied by oxy-acetylene welding are inclined to be harder than the same metal welded by other methods. This is particularly true of cobalt-base rods.

With metallic arc welding, the concentration of heat is localized. This fact favors the process when it is necessary to leave the base metal with unchanged structure and free from warpage. Greatest tonnage of hardfacing alloys is applied by this method. It is desirable for building up manganese steel and where finishing is not necessary. Cobalt-base rods should be coated and applied with D-C reverse polarity.

Inert gas shielded arc welding—both with filler rod and non-consumable electrode — is used in many critical jobs where no other method will do. With non-consumable electrodes, backhand welding and A-C minimize dilution.

Carbon arc welding is used to fuse-on carbide, particularly chromium carbide in thin overlays for highly abrasive service.

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**QUALITY CONTROLLED**
**STAINLESS STEEL**
**Welding Wire**

- **available in Spools, Coils and Lengths**
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Welding wire by Drawalloy is made to an exacting high standard . . . a high standard established by long-experienced welding men who know welding wire and how it must work. Set-ups for automatic and semi-automatic welding take more time than regular welding. That's why you want to be sure of satisfaction *before* you start. This *reliable* wire is weld-tested to give the best results every time. Write today for complete information and prices.

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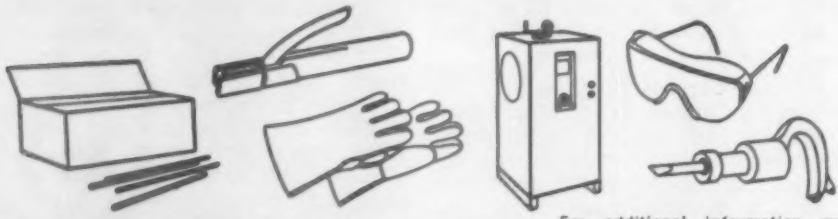


# new products

For additional information on the products appearing on this and the following pages, mark the key number of the item on the card bound into this issue. Drop the card in the mail—no postage is required.

## Heavy-Duty Arc Welders

The Viking line of heavy-duty industrial arc welders recently acquired by Mid-States Welder Mfg. Co. consists of three different types: straight AC transformer welders up to 500 amps rated output, inert gas-type AC welders of 200 and 300 amps rated capacity and DC rectifier-type units rated at 200, 300 and 400 amps, together with remote control devices for the latter. Coupled with Mid-States' standard models down to 95 amps, the company offers one of the broadest lines of welders in the industry.

**Circle No. 32 on Reader Service Card.**

## Spatter-Proof Compound

Developed to prevent adhesion of weld spatter, Spat-R-Pruf Compound 106 has been introduced by York Engineering Co. The compound is said to completely eliminate grinding away of spatter and resulting marred surfaces. One coat of the compound makes it possible to wipe away spatter with a dry cloth.

Non-toxic and non-flammable, the compound is odorless and harmless to the skin. It helps prevent rust and can be used as a paint base.

It is available in one or five gallon cans and 55-gallon drums.

**Circle No. 161 on Reader Service Card.**

## Ram-Type Pedestal

A ram pedestal designed for longitudinal welding and for use with turn tables, turning rolls or positioners has been developed by Cayuga Machine and Fabricating Co. The unit supports the welding head and wire reel in automatic set-ups, and provides 360° rotation. Unit is said to be precision built and light in weight.

**Circle No. 178 on Reader Service Card.**

## Automatic Welding Fixture Has 3-Directional Operation

Lewis Welding & Engineering Corp. has announced development of a new universal fixture which has full portability, simultaneous 3-directional travel, 360° boom rotation and an adjustable base. Any standard head can be used with fixture for automatic welding, flame cutting or hardening.

Alignment for longitudinal and transverse welds is made by an adjusting wheel at one end of base. Once set-up is complete, unit is operated by remote pushbutton controls that permit 3-directional travel. Speed is infinitely variable and ranges up to 72 ipm of travel.

The "Universal" welder has 18-feet of longitudinal travel and can be furnished with booms and columns of various lengths. Transverse travel of boom and clearance range from 8 to 12 feet.

**Circle No. 48 on Reader Service Card.**

# NEW
# Arc Welding System
## using
# Murex® CROLOY Electrodes

**for Welding CHROME-MOLY STEEL used in HIGH TEMPERATURE—HIGH PRESSURE SERVICE**

*See M & T's full line of electrodes at the AWS Welding Show Kansas City, June 8-10, Booth 250*

- **PRODUCES JOINTS AS DEPENDABLE AS THE METAL YOU WELD**
- **SIMPLIFIES THE WELDING OPERATION**
- **SAVES YOU TIME AND MONEY**

M & T now brings you a new arc welding system using Murex CROLOY electrodes for fabricating and repairing chrome-moly steel equipment used in high temperature—high pressure service.

For years one of the nation's foremost producers of power piping and high pressure boilers has been using CROLOY electrodes in production. Their experience has proven the excellent operating characteristics of the electrodes, the dependability of the welds under high temperatures and pressures, the economy of the welding system.

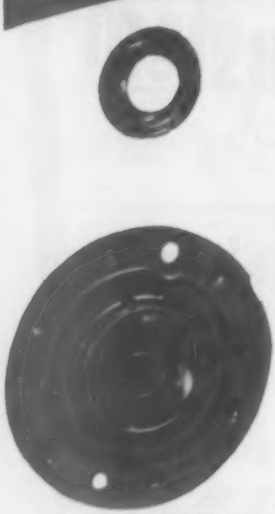
With the new system you can greatly simplify preheat and postheat operations . . . you can practically eliminate underbead cracking, forget about costly defective welds . . . you can dispense with stress relieving on many weldments . . . you can weld chrome-moly steels more economically.

Murex CROLOY is a chrome-moly weld metal of outstanding stress rupture characteristics and high ductilities over a wide range of temperatures. Further information is available on this new welding system and the unique electrodes that have made it possible. Just write, or have a Murex man call.

**METAL & THERMIT CORPORATION**
*Welding Division*
100 EAST 42nd Street • NEW YORK 17, NEW YORK

**Circle No. 78 on Reader Service Card.**

# How Federal Welders help build better motors



To get more efficient assembly of an end head on a fractional horsepower motor, a leading automotive parts manufacturer came to Federal. The result — a standard Federal Bench Type Projection Welder with a special 8 station dial feed operated through a Geneva motion drive that completes 1600 assemblies per hour.

Federal uses a Reeves drive arrangement operating through a gear box to permit flexibility of adjustment of indexing rate. The die slide is spring loaded to insure identical weld force at each station. The manufacturer finds this welder gives a more uniform motor end head, in greater quantities, at reduced costs.

This is another example of how Federal's resistance welding "know how" is paying dividends to one of America's leading industrial concerns. Why not, when next you're considering welding, call *Federal—First in Resistance Welding.*

Federal® WELDERS

Warco® PRESSES

THE FEDERAL MACHINE & WELDER COMPANY

WARREN, OHIO

Circle No. 69 on Reader Service Card.

## Cable Packaging Program

Because welding cable is usually purchased in certain standard lengths, Belden Manufacturing Co. has instituted a new cable packaging program. Belden is supplying continuous lengths—25, 50

and 100 feet—in sturdy, attractive individual cartons in all standard gauges. The line also includes 250-ft. coils and 1000-ft. reels. This set-up is intended to simplify distribution problems and effect economies by making stocking and handling more efficient.

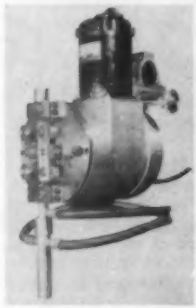
**Circle No. 46 on Reader Service Card.**

## Aluminized Safety Clothing

Newest addition to the line of safety and protective clothing made by Aljay Manufacturing Co. uses of aluminized asbestos and aluminized duck in coats, aprons, gloves, bibs, overalls, spats, sleeves and curtains. This material will not crack or chip, will reflect 90 percent of radiant heat and has greater abrasive resistance. Since material weighs half as much as asbestos it permits greater freedom of worker action and minimized operator fatigue.

**Circle No. 163 on Reader Service Card.**

## Automatic Welding Head



Developed for operation with submerger arc, open arc or mechanized inert arc welding, the new Raco BW-2 automatic welding head is designed for operation with variable voltage or constant potential power.

**Circle No. 164 on Reader Service Card.**

## Dual-Control Regulators

The new Weldit Series 50 duo-control regulator for oxygen and all fuel gas control has been introduced by Weldit, Inc. Called "Duo-Troll," the regulator is said to be precision built to take rough handling and still give utmost in accurate regulation. Compact in size, with

forged body and bonnet, it is adapted for both light and heavy duty work.

Simple design is rugged, safe and dependable and is easily repaired with standard tools. Full view gauges are easily read and new filter gives maximum seat protection. Duo-Trol safety automatically resets itself. Steady flow is guaranteed at all working pressures. Regulator is adaptable for use with flowmeter.

**Circle No. 4 on Reader Service Card.**

## Spectacle-Type Goggles

New spectacle-type goggles introduced by Welsh Mfg. Co. have colorful frames made from strong, light butyrate. Temples are available in plastic covered, flexible cable or metal-cored paddle

style. Keyhole-type bridge of butyrate rests easily on the nose. Flat or curved lenses are available in clear or green-hardened glass or in lighter weight plastic. Solid or perforated shields are available in clear or green acetate.

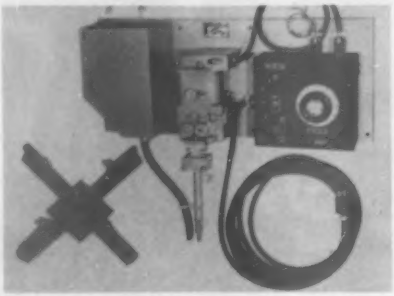
**Circle No. 174 on Reader Service Card.**

## Automatic Welding Head

Hobart Brothers Co., Troy, Ohio, has introduced a new automatic welding head designed for use with their new constant voltage welder

The complete unit consists of simplified controls, wire feed and current pick up assembly, flux hopper, and wire reel. If a different arrangement is desired, any one or more of the components can easily be removed from the steel panel to setup the job at hand.

Head has capacity for automatic welding with wire sizes .035" to ¼" inclusive.

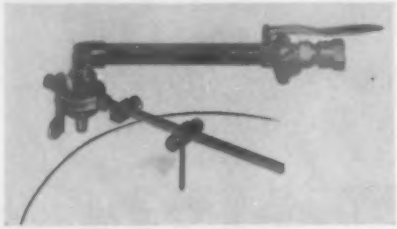


One set of wire feed rolls, size specified by customer, is standard equipment. Other sizes are available at nominal extra price. Capacity of the flux hopper is 25-lbs. and the adjustable wire reel will handle coils 12" to 16" I.D., 2½" to 4" wide. The reel can be located at the most desirable point for the job at hand. Reel for 22" coils is available at extra price.

**Circle No. 168 on Reader Service Card.**

## Universal Circle Burner

Designed to cut circles, straight lines and straight line bevels a new cutting attachment for flame cutting torches has



been introduced by Wagner Mfg. Co. The precision-made burner is said to be guaranteed to meet every requirement

**Circle No. 169 on Reader Service Card.**

## Special Flux for High Temperature Brazing

A special flux for silver alloy brazing of stainless, chromium heat resisting alloys, chromium and tungsten carbides is being offered by Handy & Harman. Called Special Handy Flux Type B-1, the new flux is designed to reduce oxides of the refractory metals while protecting the underlying metal from further oxidation during brazing.

An important feature of the new flux is its ability to withstand heating at 1400-1600 F for short times and to increase its life at lower brazing temperatures. The key to the unusual performance of the flux is that it contains a strong deoxidizer and one whose oxide is a flux former. In a sense the flux regenerates itself during the heating cycle and thus provides the longer activity span required for elevated temperatures. After brazing, the flux can be removed readily with hot water.

**Circle No. 170 on Reader Service Card.**

CIRCLE NUMBERS ON THE CARD AND MAIL!

## Vertical Toggle Clamps

Vertical-pressure toggle clamps have been introduced by Erico Products, Inc. Available in three sizes, Caddy Type H clamps are available in three sizes

having 800, 1000 and 2000 lbs. clamping pressures.

Clamps are designed for use on jobs with limited space for vertical handle such as found on Caddy Type V clamps.

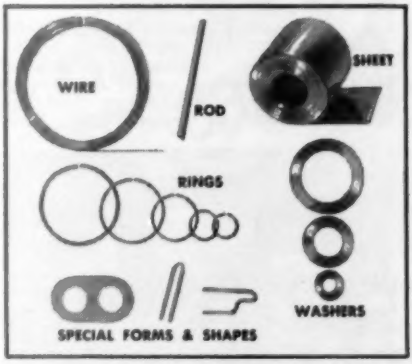
**Circle No. 171 on Reader Service Card.**

## Hard Facing Electrode

A hard facing electrode developed by Mir-O-Col Alloy Co. is claimed to be especially good for work on manganese castings. Available in full range of sizes, new electrode, called Moly-Mang, comes in hermetically sealed packages to avoid moisture pick-up.

**Circle No. 172 on Reader Service Card.**

# WHY are EASY-FLO and SIL-FOS the largest selling silver brazing alloys in the United States?




**There's no "*or equal*" for EASY-FLO and SIL-FOS and for the SERVICE that goes with them**

**1.** Because these low-temperature silver brazing alloys — developed and patented by Handy & Harman over 20 years ago — are outstanding in their remarkably fast brazing action and ability to make high-strength, liquid and gas tight joints in ferrous, non-ferrous and dissimilar metals. These results are inherent in their time-tested compositions and physical properties.

**2.** Because thousands of brazing alloy users recognize this important **PLUS value** that goes with the alloys—Handy & Harman's unmatched technical knowledge about silver alloy brazing and practical field experience in its application, backed by research and development facilities unequaled in the industry. These SERVICES are always available to every user, without obligation. They assure maximum benefit from the use of EASY-FLO and SIL-FOS.

## SEND FOR THIS DISTRIBUTOR LIST

You can get the real EASY-FLO and SIL-FOS alloys and their companion low-temperature HANDY FLUX, only from Handy & Harman Authorized Distributors, located in principal centers throughout the country. Write for the "Distributor List" and contact the one nearest you.

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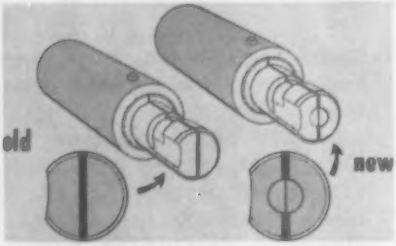
MONTREAL, CANADA

Circle No. 80 on Reader Service Card.

## Improved Cable Connector

A new, improved cable connector has been introduced by Cam-Lok Division of Empire Products, Inc. New construction increases the stability of the solid brass connector, which utilizes a double cam action for a positive, high pressure electrical cable connection.

The male section of the Cam-Lok Connector is now split. When inserted




in the female section, a strong wiping action is produced. With the new construction, the tips of the split halves are indented, limiting their travel and producing indefinite tension life.

In addition, protection of the male part while disengaged is provided to resist damage from abuse, rough handling or accidents.

**Circle No. 55 on Reader Service Card.**

## Gas Economizer Gauge

Development of the new No. 55 "Economizer" gauge for use with oxygen, acetylene, air and $CO_2$ has been announced by Dockson Corp. The unit ac-

commodates two gauges, conserves valuable space and can be supplied with inlet fitting for all tanks. For easy and quick reading, the 2-inch all-brass gauges have large, clear, well-marked dials. The unit is light-weight (about two lbs.) yet is sturdily built for rugged usage.

**Circle No. 166 on Reader Service Card.**

## Portable X-ray Unit

Designed for examination of welds at a short focus-film-distance, "Fedrx 120s" has a high 120 kvp rating, 5 ma, but weighs only 75 lbs., according to Machinery & Welder Corp. Short exposures, easy handling and economy in service are said to be due to a high definition X-ray tube and a short focus-film-distance. Unit will penetrate up to 1¼-inches of steel.

Three other models of similar machines have maximum penetration ratings of approximately 2, 3 and 4-inches.

**Circle No. 175 on Reader Service Card.**

## New Welding Positioner

A new welding positioner introduced by Aronson Machine Co. is available in 500 and 1000 lb. capacities. Model D positioner has 4-inch center of gravity location and zero to 3.75 rpm table rotation with built-in free wheeling. Fea-

tures include precision-cut steel gearing, magnetic braking, precision limit switches and mercury grounded main spindle.

Unit has 23-inch round machined table with four slots for ½-inch bolts; base is adjustable for 17¾-inch minimum—32-inch maximum in two steps of 7-inches each.

**Circle No. 176 on Reader Service Card.**

## Manganese-Nickel Electrodes

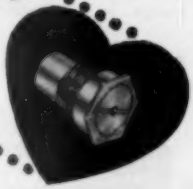
A new 11-13½ percent manganese-nickel steel welding electrode that has the easy operating characteristics of mild or stainless steel electrodes is being marketed by Stulz-Sickles Co. With all the alloys in the wire and not in the coating, the Manganal Flo-Kote electrode is said to produce tough, ductile weld deposits with full and uniform work-hardening and tensile properties.

The Flo-Kote coating is said to eliminate peening, weaving the bead and puddling the arc. Sound stringer beads can be run without porosity or cracking in vertical or overhead positions, as well as downhand.

**Circle No. 177 on Reader Service Card.**

NEW R-90 SERIES

# SINGLE-STAGE COST 2-STAGE EFFICIENCY



"Capsule" Control Unit is heart of stabilized pressure control. No re-setting as cylinder empties—quick, "on-job" replacement.

NEW Gaswelds

## BALANCED-PRESSURE REGULATORS

- **Set It and Forget It!** Maintains stable delivery pressure as gas is consumed. Eliminates constant regulator re-adjustment.
- **Amazing Low Cost** due to new simplified design. Approximately 40% less than 2-stage, 20% less than most single-stage regulators.
- **New, "Capsule" Control Unit** permits easy, on-cylinder repair. Fewer repair parts to stock.
- **Safety Plus**—seats protected by non-flammable nylon filter. 2¼" nickel silver diaphragm. Forged body and bonnet. Easy to read gauges.

Ideal for practically every welding and cutting job. Made and guaranteed by LIQUID CARBONIC—famous for highest quality. Write for additional details and prices.

**LIQUID also produces Oxygen, Acetylene and other commercial gases including $CO_2$ in all its forms—Gas, Liquid and Solid (dry ice) for industrial use.**

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West of the Rockies: STUART OXYGEN CO., Los Angeles In Canada: IMPERIAL OXYGEN LTD., Montreal

**Circle No. 81 on Reader Service Card.**

## Nickel-Base Electrode For Welding Cast Iron

A new welding electrode with a (special powdered iron) coating is announced by the Marquette Manufacturing Company. Known as Nicol-Rod No. 99, it alloys pure nickel with iron to produce dense, high strength, machineable welds in gray, malleable and ductile cast irons.

Its outstanding advantage is the ease with which welds can be made. The arc is self-starting and the rod re-ignites without freezing to the work. A softer, more stable arc is obtained with A.C. or D.C., straight or reverse polarity. Of particular importance is that the arc is more stable on low, open circuit voltages.

**Circle No. 165 on Reader Service Card.**

CIRCLE NUMBERS ON THE CARD AND MAIL!

## Raised Hub Disc-Wheel

Changes in the Blue Flash "BF" raised hub disc-wheel recently introduced by Bay State Abrasive Products Co. are said to have substantially increased weld grinding and finishing speeds. Changes, designed to take maximum advantage of the cutting ability of each abrasive grain, permit them to penetrate deeper and take bigger bites of metal.

**Circle No. 22 on Reader Service Card.**

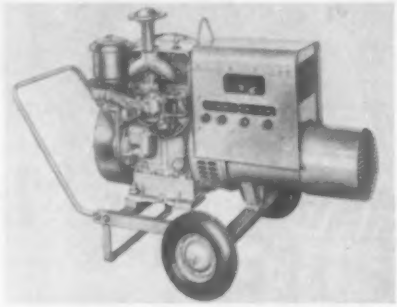
## Round Moly Rod

Because of the increasing demand for molybdenum rod, the Weld Rod Division of Chicago Hardware Foundry Co. is again offering their "Round Moly No. 15." This rod will be made in two sizes only: $\frac{1}{8}$ and $\frac{1}{4}$-inch by 24-inches long. Deliveries will be made within a reasonable time after receipt of order.

**Circle No. 167 on Reader Service Card.**

## Engine-Driven Welder

Light weight, small space requirements and low cost in heavy-duty units are some of the advantages claimed by Harnischfeger Corp. for its new WN-180 engine-driven arc welder. The lightweight, heavy-duty unit is said to be ideal for heavy construction work, as



well as for garage, farm and repair shop application.

Weighing only 425 lbs., WN-180 has a service range of 20 to 200 amps. Unit has detachable, 2-wheel mounting and can be mounted on a jeep or small truck.

Unit is powered by an industrial-type 12-hp, 2-cylinder, 2000 rpm Wisconsin air-cooled engine. Air-cooling prevents freezing in cold weather.

**Circle No. 180 on Reader Service Card.**

## Liquid Brazing Flux System

A new "Jet Flux" system developed by All-State Welding Alloys Co., Inc. applied flux to work by introducing liquid brazing flux into gas stream. System is composed of automatic dispenser which meters liquid flux into gas stream and "Jet Flux" liquid which has been compounded for brazing with bronze, nickel-silver and

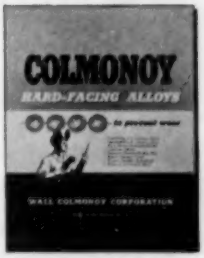
**Circle No. 58 on Reader Service Card.**

# Now...

## Get Easier Application with Colmonoy Hard-Facing Rod

Two great alloys, Colmonoy No. 1 and Colmonoy Special No. 1, now have a new metallic coating that improves weldability and arc stability. No weld cleaning is necessary between successive passes, and welding may be done vertically. New moisture-proof cans keep rods fresh. Use No. 1 for high impact applications, and Special No. 1 for extreme abrasion resistance. Available in 1/8", 3/16", and 1/4" diameter electrodes, for DC electric arc welding.

***Write for Colmonoy Hard-Facing Manual No. 77.***




***HARD-FACING ALLOYS***

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CORPORATION

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*LINDEN • MORRISVILLE • PITTSBURGH • MONTREAL • GREAT BRITAIN*

**Circle No. 82 on Reader Service Card.**

# Dual Protection!

**New WILLSON *2-in-1* HELMET / SAFETY CAP COMBINATION**

Welders who need full protection for the head as well as face and eyes now get extra comfort and safety . . . all ways! Outstanding features include:

★ Both safety cap and helmet are one-piece Fiberglas reinforced plastic—lightweight, moisture proof, heat resistant—and tough!

★ Well-balanced helmet features push-button fastener for quick removal at will!

★ Lightweight safety cap available with exclusive patented "geodetic suspension", providing maximum comfort and safety.

Ask your Willson distributor to show you this new 2-in-1 combination—or write for latest bulletin.

Over 300 safety products carry this famous trademark

WILLSON

Leaders in Research and Development of Safety Equipment Since 1870

**WILLSON PRODUCTS, INC.**
223 Washington St., Reading, Pa.

**Circle No. 83 on Reader Service Card.**


## HOW TO GRIND STAINLESS

*(Continued from Page 82)*

not only in the actual finishing operation, but also in the initial cost of material. Where specifications permit, it is possible to purchase lower grade mill finishes. With the variety of abrasives available today, any finish from dull to a bright satin finish can be achieved with a wicking wheel. Satin finishes have the advantage of blending in with die marks and other imperfections.

The wicking wheel operates best at relatively low speeds—approximately 800 to 1800 surface feet per minute. Because their flexible, cushioned surface always stays soft, wicking wheels "hold" an abrasive better than other wheels. This makes it possible to increase grit size sequence faster.

### No Pressure With Wicking Wheel

No appreciable pressure should be applied when using a wicking wheel. The surface of the wheel should not be bent to any considerable extent when in contact with the surface being polished. Abrasive compounds for securing satin finishes are available in grits from Nos. 36 to 320 in both stick and cake form.

Correct care of wicking wheels, such as periodic cleaning or removing old abrasive with a coarse file, insures a soft polishing surface that lasts a long time.

In working on large surfaces care must be taken to set up equipment beforehand so that the wicking wheel may travel the full length of the work at one stroke. Interruption of the stroke will cause polishing marks to remain. For this type work, flexible shaft equipment is particularly well suited.

Finishes can also be applied with treated Tampico brushes. This is accomplished through use of a No. 120 grit with a lubricant. Commercial No. 6 finish is produced by brushing a surface which has a No. 4 or higher finish with a treated Tampico brush and a compound of fine abrasive and oil mixed to a consistency of light paste.

By applying the basic principles outlined here, it is possible to eliminate surface defects caused by welding. Often, it is impossible to find weld marks even with close scrutiny.

Photos and data courtesy of R. G. Haskins Co.

## R.W.M.A. Reports Increase in Shipments

First quarter shipments of resistance welding machines have increased 16 percent over the same quarter of 1954, according to an announcement made at a recent meeting of the Resistance Welding Manufacturers' Association.

## Personnel Changes at Ampco Metal, Inc.

J. P. Henry, formerly assistant general sales manager, has been appointed General Sales Manager of Ampco Metal, Inc,, Milwaukee.

J. P. Henry

R. J. Severson

R. J. Severson, formerly manager of technical sales, will assume the duties of Assistant General Sales Manager. Appointments were announced recently by J. D. Zaiser, president.


THE NAME PREFERRED BY THOSE WHO KNOW WELDING!

Trindl

SUPER-INDUSTRIAL

ARC WELDERS

FOR EVERY JOB AND EVERY PURSE

OUTSTANDING FEATURES ASSURE PEAK WELDING EFFICIENCY!

Designed and built to meet the most exacting demands of industry. A complete range of A.C. arc welders that have undergone constant on-the-job tests and achieved numerous records for durability and continuous operating performance without work stoppage. Superior craftsmanship and materials assure stable arc and strong penetrating welds. Range from 80 amp to 400 amp machines.

WRITE FOR COMPLETE DETAILS AND ILLUSTRATED LITERATURE and solve your welding problems.

*Trindl D17 Carbon Arc Torch fits every AC-DC Arc Welder.*

TRINDL PRODUCTS, LTD.

1807-11 S. Clark Street • Chicago 16, Illinois

Dept. T-34-F

Circle No. 84 on Reader Service Card.

## DV Appoints Henry

Harold Henry has been appointed Sales Engineer for DV Controls Division of Engineered Instruments, Inc. In this capacity he will cover the Greater Los Angeles area with DV's line of automatic welding controls. Formerly with DuPont, Mr. Henry has also been active in U.S. Navy engineering circles.

## Tucson Chapter of A.W.S. Honors Welding Student

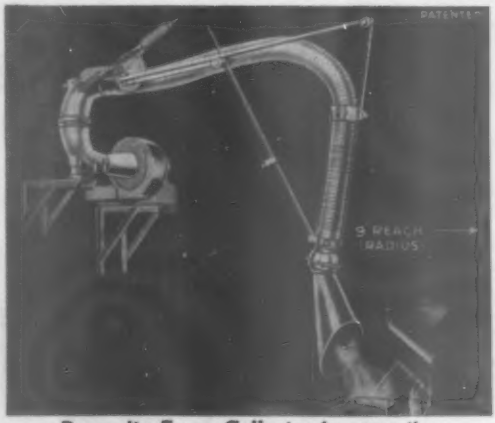
Tucson Chapter, American Welding Society, recently announced that the most proficient welding student enrolled in a vocational high school welding course in Southern Arizona would receive more than $300 worth of welding equipment. Joe Brennan, chairman, made the award at the group's April meeting.

The award consisted of a complete welding and cutting outfit presented by Victor Equipment Co. and their Arizona distributor, Aweco Supply Co.; a set of oxygen and acetylene cylinders donated by Dye Oxygen Co. and a hardfacing kit given by Rankin Mfg. Co.

## Willson Products Elects New Officers

Willson Products, Inc., manufacturer of Sun Glasses and Industrial


REMOVE WELDING FUMES at the Source— with RUEMELIN FUME COLLECTOR




*Ruemelin Fume Collector in operation.*

Welding shops equipped with Ruemelin Fume Collectors are assured of a clean shop atmosphere. Noxious fumes, heat and smoke are eliminated AT THEIR SOURCE. Improves working conditions . . . lessens fatigue . . . paves the way for increased plant production. Especially helpful in winter months when windows and doors are closed. Note the new spring-loaded counterbalance mechanism which makes Fume Collectors much easier to handle. Ask for Bulletin 37-E illustrating this new feature.

RUEMELIN MFG. CO. 3891 N. PALMER ST. • MILWAUKEE 12, WIS., U. S. A.
Mfrs. and Engineers • Sand Blast and Dust Collecting Equipment

Circle No. 85 on Reader Service Card.

Safety Equipment has been purchased by Ray-O-Vac Company of Madison, Wisconsin. The Reading, Pennsylvania firm, founded in 1870, makes safety goggles, respirators, welding goggles, safety hats, and Willsonite Sun Glasses.

Mr. J. Clyde Ryan, executive Vice President of the Ray-O-Vac Company, Madison, Wisconsin, was elected President and General Manager of Willson Products, Inc., following the annual stockholders meeting.

Mr. Ryan succeeds Mr. Thomas A. Willson who was elected Chairman of the Board of Directors. Dr. Frederick Willson, who has been Chairman of the Board since 1942, has retired. Thomas A. Willson, Jr. was elected Vice President in Charge of Production, thus leaving two generations of the Willson family represented in the firm.

## General Electric Names 3 New Distributors

Three new distributors have been named to handle products of General Electric Company's Welding Department, it was announced by E. K. How, sales manager.

Named were Weld-Arc Sales and Supplies, Inc., New York City; Interstate Welding Supply Corp., Elizabeth, N.J., and T. H. Green Co., Rochester, N.Y.

## Feature P&H Equipment at Cleveland Showing

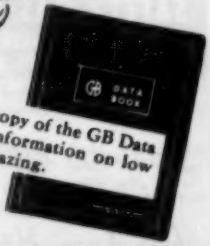
Important new developments in their complete line of welding machines and electrodes were featured at a special presentation by Harnischfeger Corporation in Cleveland's Masonic Hall early last month. A variety of new and improved welding machines and electrodes were on display.

for

**Speed • Efficiency • Economy**

GB Silver Brazing Alloys meet all standard specifications. Available in random coils, strip, preformed rings and special shapes. This is your answer to sound, leakproof joints on virtually any ferrous or non-ferrous metal. Silver Brazing Alloys are easy to use in production, save time, labor and assure dependable results.

GB 88 Flux, an aid in silver brazing operations, a time-tested product, assures you of maximum protection and high quality joints. Team up a GB Alloy and Flux for dependable results. Other GB Fluxes available for specialized application.




Write for your free copy of the GB Data Book . . . complete information on low temperature Silver Brazing.

*Dealer Distributor inquiries invited*

SEE YOU AT THE KANSAS CITY SHOW • BOOTH No. 131

Goldsmith Bros.
SMELTING & REFINING CO.
1300 West 59th Street, Chicago 36, Illinois

PLEASE SEND GB Data Book without obligation.

Name_____

Address_____

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Circle No. 87 on Reader Service Card.

## G.E. Welding Supervisor Tours 11 European Countries

Roger W. Clark, manager of the welding sub-section of the Materials and Processes Laboratory of the General Electric Company's Large Steam-Turbine-Generator Department, Schenectady, was one of a 30 man team which spent four weeks studying welding techniques used in 11 European countries. He is one of three United States representatives on the Intra-European Mission on the Study of Welding sponsored by the European Productive Agency of the Organization for European Economic Cooperation.

## Appoint C. P. Sander to A.W.S. Tech Council

C. P. Sander, general superintendent of the Consolidated Western Steel Div., U.S. Steel Corp., Vernon, Calif., has been appointed a member of the Technical Council of the Board of Directors of the American Welding Society. Technical Council is composed of authorities in the welding industry


*Industry's Fastest Selling CYLINDER TRUCKS*

*Many Styles For all Sizes of Cylinders*

Write for full Information

LT-200 KC-50

**Welded Truck & Specialty Co.**
1300 DIVERSEY PKWY • CHICAGO 14, ILLINOIS
SOLD ONLY THRU "INDEPENDENT DEALERS"

ASK THESE DEALERS

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640 W. Lake Street
Chicago 6, Illinois

**GIBSON WELDING SUPPLIES, INC.**
E. 218 Trent Avenue
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**JONES WELDING SUPPLIES**
225 Eleventh St., S.E.
Roanoke, Virginia

**MOBILE WELDING SUPPLY CO.**
P. O. Box 1418
Mobile, Alabama


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and is charged with supervision, planning and expediting all technical affairs of the Society.

**Address for J&H Products**

Please note that J&H Products, Inc., manufacturers of vibration dampener for weld grinding, is located at 3007 Elm St., Dallas 1, Texas. This address was omitted from the company's advertisement in May INDUSTRY & WELDING Magazine.

## Standard Portable Cord Moves to New Location

Standard Portable Cord Co., formerly located at 1300 East Second St., Jamestown, N.Y., has announced that its plant is back in full production after removal to their new and larger Mayville, N.Y., plant. The firm manufactures a large number of portable industrial products, including magnetic clamps for positioning weldments.


Circle No. 89 on Reader Service Card.

**TIMANG WELDING ROD and REPAIR SHAPES for welding MANGANESE STEEL**

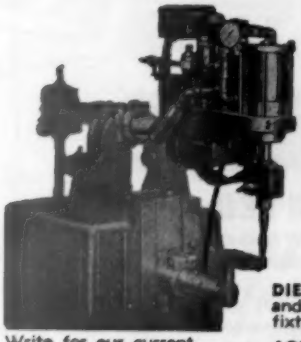
**TIMANG** welding rods assure economical, uniform welds. They equal the parent manganese steel in hardness, durability, strength, and work-hardening properties. Air-toughening, TIMANG needs no quenching.

Taylor-Wharton Manganese Steel Welding Repair Shapes, together with TIMANG welding rods, duplicate the wear-resistant qualities of the original material. They assure sound welds, with extreme economy and service life.

*See your welding supplier.*
*Send for Bulletin No. 451.*

**TAYLOR-WHARTON IRON & STEEL CO.**

(Div. of Harrisburg Steel Corporation)
HIGH BRIDGE 8, NEW JERSEY
Cincinnati, O., Birmingham, Ala., Easton, Pa.



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*Solve Your Welding Problems*
**at HOFFMAN-CHICAGO**

**Spot, Butt, Seam, Gun, Flash, Projection, Multi-Point and Stud Welders**

**NEW • USED • REBUILT**

**← WELD-AIR-MATIC**
Spot welder air conversion unit. Tests prove 10,000 welds hourly on continuous daily schedules.

**BUTT-ON-SPOT →**
Automatic butt welding attachment. Water - cooled, fits any spot welder with minimum horn clearance of 7".

**DIES:** complete facilities to design and build special welding dies and fixtures for your piece parts.

**ACCESSORIES:** complete stock of Welder Controls, Holders, Tips, and Bar Stock.

**ROBT. W. HOFFMAN CO., INC.** 38 South Clinton Street, Chicago 6, Illinois

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Circle No. 91 on Reader Service Card.

*Welder's Special!*
**GRIPSO** triggermatic
**VISE PLIERS**
COPPERPLATED FOR PROTECTION

Just as your mask and gloves protect *you*, so the copperplating protects this most valuable tool from welding spatter and from being welded to the work. The finest tool of its kind in the business. Adjusts, locks, releases, all with one hand. Clamp, hand vise, pliers, pipe and nut wrench, all in one. Holds parts securely for welding, cutting, grinding. An item every welding Jobber will want to stock. Get the whole Gripso story today. Write H. R. Basford Co., Dept. W, 235 15th St., San Francisco 3, Calif. (Warehouses Chicago, Ambler, Pa., New York City.)

## Use Iron Powder Low Hydrogen Electrodes

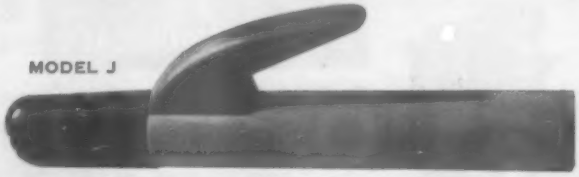
*(Continued from Page 137)*

thereby realizing the advantage of greater deposition rates. For instance, it may be shown that in vertical welding the iron powder low hydrogen electrodes deposit weld metal 44 per cent faster than the old standard vertical welding electrode, the E6010 type, when each type is welded at its optimum current.

### Better Use of Electrical Energy

Although the coating of iron powder low hydrogen electrodes is not an effective electrical conductor so far as shorting through is concerned, it is sufficiently conductive to assist in carrying the welding current. The core wires of iron powder electrodes do not overheat from electrical resistance when the electrodes are welded with high current. With conventional low hydrogen electrodes, welded at the same high current levels, the core wires become excessively hot, thereby further reducing the efficiency of the welding and quality of the weld metal.

With today's increasing labor




**H. J. WAGNER'S NEW PATENTED HOLDER**

**Available in 250, 300, 400 and 500 Amperes**

NEW flush joining of upper and lower tongs. No pivot pin.

NEW cable connector clamps around cable — holds insulation and absorbs shocks.

NEW molded lever actuates, but is not part of, the upper tong.

LIGHTWEIGHT.....Model JD, 250 Amps, weighs less than 15 ozs.

*Write for illustrated literature*

**H. J. WAGNER PRODUCTS, Inc., Box 28-J, Jackson, Missouri**

Circle No. 92 on Reader Service Card.

and overhead costs, the only real way of lowering manufacturing costs of weldments is by increasing the efficiency of the welding operation. The use of iron powder low hydrogen electrodes results in greater efficiencies in at least two important ways: greater deposition rates and less operator fatigue. The greater deposition rates result from both the higher welding currents which should be used with the electrodes and the more efficient use of the electrical energy.

## Norton Announces Sales Changes

Two changes in Norton Company's sales organization have been announced. Harlan W. Cobb has been appointed a field engineer in the New England-New York State territory and Alfred C. Womer will replace Mr. Cobb as Abrasive engineer in the Northern Ohio area. Mr. Womer was formerly a field engineer in the Cleveland District office.


MEETS EVERY STANDARD ACROSS THE WORLD!

The leader for over forty years.
Quality in any quantity.

SHAWINIGAN
PRODUCTS CORPORATION
EMPIRE STATE BLDG. • NEW YORK 1, N.Y.

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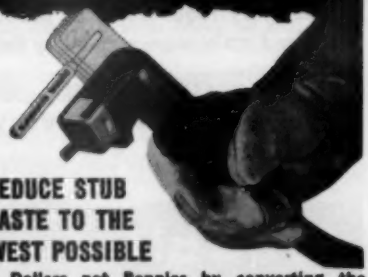
"Shortstub"
ELECTRODE
HOLDERS



REDUCE STUB WASTE TO THE LOWEST POSSIBLE

Save Dollars not Pennies by converting the total fluxed portion of all Electrodes into Weld Metal.

See your Local Welding Supply Dealer

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| SHORTSTUB Model No. 4 | 400 amp. | $6.90 each |
| SHORTSTUB Model No. 6 | 600 amp. | $7.90 each |

Quantity prices save you 10 to 20%
Request 16 Page Booklet Form SS-3

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BERNARD WELDING EQUIPMENT CO.
10230 SOUTH AVE. N • CHICAGO 17, ILL.

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Circle No. 95 on Reader Service Card.

**Crobalite**
cobalt-chromium-tungsten
**HARD-FACING ALLOYS**

**Easy to apply**
by arc or torch. Flow on extra-readily in a uniform, slag-free layer.

**Give Superior Resistance**
to abrasion, corrosion, oxidation and impact—with high hardness—even at red heat.

**Three Proven Grades**
meet every requirement of production and maintenance, in every field.

**FREE CROBALITE BULLETIN** gives details. Write for it — today!

**DISTRIBUTORS:** We invite your inquiries.

**Crobalt, Inc.**
2800 S. State St., Ann Arbor 2, Mich.

## American Brake Shoe Takes Over Lynch Compressors

American Brake Shoe Co. has taken over the air compressor business of the Defiance, Ohio, plant of the Lynch Corporation, William T. Kelly, Jr., vice president, recently announced. Mr. Kelly said that American Brake Shoe has purchased rights of the Par air compressor manufactured by Lynch for the past 20 years. The Par line ranges from 1/3 to 10-hp compressors.

## Oehler Heads Manufacturing at American Welding

Dr. Irving A. Oehler has been named Manager of Manufacturing at American Welding and Manufacturing Company, Warren, Ohio, according to William J. Sampson, Jr., president. Formerly Administrative Assistant to the President, Dr. Oehler will be in charge of and supervise all manufacturing processes and related services.

**Aronson TWINNER MAGNETIC CLAMPS**

**Welding Aids with a Thousand uses!**

**Aronson MACHINE CO.**
ARCADE, NEW YORK

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CUTS WELDING COSTS WITH
**NO SPAT**

**Non-Toxic, Smokeless Welding Fluid**

**NO SPAT** eliminates slow, costly grinding, chipping, cleaning of weldments, keeps welding jigs spatter-free. Suppresses fumes; no carbon monoxide. Prevents rust, conditions metal surfaces for painting. Ready to use. Test **NO SPAT** now! Write for **FREE** sample.

THE **MIDLAND PAINT & VARNISH** CO.
3804 EAST 91st ST. • CLEVELAND 5, OHIO

Circle No. 97 on Reader Service Card.

## Absco to Handle Entire P & H Line on West Coast

One of the best known, most progressive welding equipment suppliers in the country, Absco, Inc. has been appointed exclusive Harnischfeger distributor in the immediate Los Angeles area.

Formed in 1942 by Milt Sims who had previously spent 19 years as a representative of Linde Air Products Co., Absco was almost immediately a successful enterprise. It soon became necessary to add capable personnel. Charlie Concannon, now Vice President and Sales Manager, and Bob Edwards, Vice President and Operations Manager, then joined the organization.

During his first four years in business, Milt Sims also conducted a contract welding shop. Specializing in aircraft components, this shop rapidly grew from a four man operation to one of the best equipped shops on the West Coast. In 1945 approximately 100 welding operators were employed.

From the opening of the first Absco supply store in June, 1945 until late 1953 when the newest most attractive office was opened


Circle No. 98 on Reader Service Card.

WHEN YOU WELD CAST IRON SELECT THE CORRECT

Fuse-Well

CAST IRON WELDING RODS OR ELECTRODES

FUSE-WELL NO. 11

FUSE-WELL No. 11, *Square*—Gray Cast Iron Welding Rod for Acetylene use in filling or building up new or worn castings producing machineable welds.

FUSE-WELL NO. 12

FUSE-WELL No. 12, *Round*—Has the same uses and analytical ingredients as Fuse-Well No. 11.

FUSE-WELL NO. 14 MOLY

FUSE-WELL No. 14, *Moly*—An Iron Base Rod with alloys added for finer grain structure and greater strength.

FUSE-WELL NO. 22

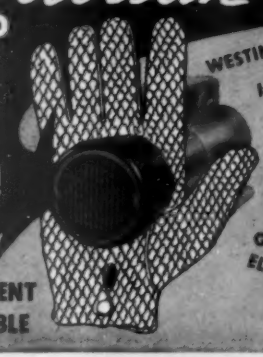
FUSE-WELL No. 22, *Electrode* — Light coated Rod to be used for AC or DC welding in the fabricating and repairing of cast iron castings.

Sold through Leading Distributors

THE CHICAGO HARDWARE FOUNDRY CO.
Weld Rod Division
NORTH CHICAGO, ILLINOIS

Airsan Welder Filters

STOP COSTLY DUST HERE!



PERMANENT CLEANABLE

WESTINGHOUSE
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GENERAL ELECTRIC

Airsan Welder Filters

Eliminate Dust to Maintain • Cooler Motors • Constant Arc • Longer Brush and Rotor Life • Greater Welder Efficiency • Constant Welder Operation • No Shut-downs • No blowing out of welders

Air Filter Corporation
100 North Water St., Milwaukee 2, Wis.

Circle No. 99 on Reader Service Card.

Circle No. 100 on Reader Service Card.

**WELDREEL**
**Welding Hose Reel**

Makes hose last 3 to 5 times longer
Provides safer, cleaner working area
Locks hose at any desired length
Retracts hose when not in use
Requires only small space for mounting on stationary or portable equipment
Model OA handles 50 feet dual hose
Model OAB handles 150 feet dual hose
Write for complete information and the name of your Weldreel dealer

WELDREEL
UNITED SPECIALTY CORPORATION
P. O. BOX 698
EL DORADO ARKANSAS

in East Los Angeles, five locations have been established. More than ten outside salesmen and 15 truck salesmen blanket the entire area. More than 50 employees now make the Absco organization click.

Absco maintains a complete repair department for all types of oxy-acetylene welding and cutting equipment, and, to a limited extent, for arc welding machines.

All management people, as well as all sales and service personnel have had both practical and technical welding experience. All equipment is quite new and modern. A substantial stock of welding supplies and accessories, all leading, well known brands, is available for immediate delivery. A complete catalog, printed and bound especially for Absco, has been distributed to about 4000 of their ledger accounts.

Absco accounts consist of all the major aircraft and steel fabricating plants in the area. These, as well as the many smaller users served, are given equal attention and courtesy. All employees work on a profit sharing basis and are proud of their contributions to the success of their company.

**JOHNSON'S**
**FLUX-'N-SOLDER**
IN *NEW* PASTE FORM
**JUST... PAINT IT ON!**
**...HEAT IT!... IT'S SOLDERED!**
THE NEW EASIER, FASTER WAY TO SOLDER . . . SAVES TIME . . . INCREASES PROFIT . . . TRY IT!

FREE SAMPLES ON REQUEST

JOHNSON MFG. CO., Inc.
Dept. W-12 Mt. Vernon, Iowa

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Reduce Your ARGON WELDING COSTS . .
with the New

**ELEMATIC**
Indicating and Recording Flowmeter
Available in two sizes:
4½" or 10" charts.
Send now for Bulletin AR-1
Elematic Equipment Corporation
6731B South Chicago Avenue • Chicago 32, Ill.
*Some territories open for distributors*

Circle No. 102 on Reader Service Card.

## Norton Opens Pacific Plant

A new plant for the manufacture of grinding wheels is being equipped and will open early next year at Santa Clara, Calif., by Norton Company of Worcester, Mass. The one story plant is at 2555 Lafayette St., 45 miles south of downtown San Francisco, and is the first on the West Coast to manufacture a full line of vitrified, organic and diamond wheels.

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## Air Reduction Releases Two New Movies

Two new moving pictures have been released by Air Reduction Sales Co. The first tells the story of Airco's tungsten inert-gas arc welding process. The second features the manufacture of calcium carbide. In full color and sound, films can be borrowed from Air Reduction Sales Co. district offices or from main offices at 60 East 42nd St., New York City. Running time of films is just under a half hour.


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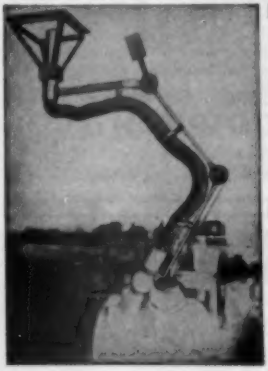
MANY EXCLUSIVE FEATURES
by
ENGWALD CORP.
"The World's Finest Exhaust Systems"



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## A.W.S. WELDING SHOW . . .

*(Continued from Page 117)*

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**VICTOR EQUIPMENT CO.** ..... **210**
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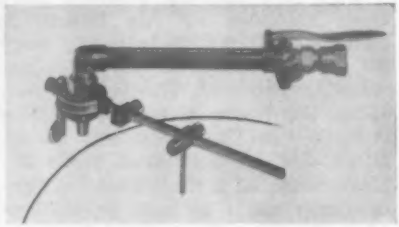

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**WELTRONIC COMPANY** .....105
Live demonstrations of electronic controls for weld timing in resistance welding operations.

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**WORTHINGTON CORP.** .....236-238
Complete line of welding positioners and turning rolls will be featured.

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**UNIQUE TURNTABLE & EQUIPMENT** .....147-148
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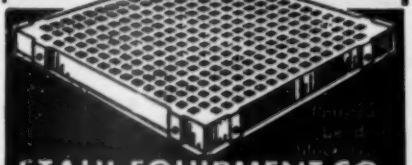

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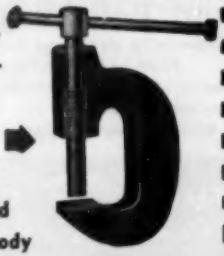

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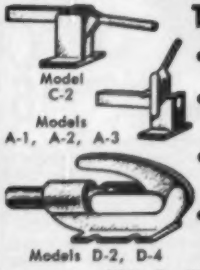

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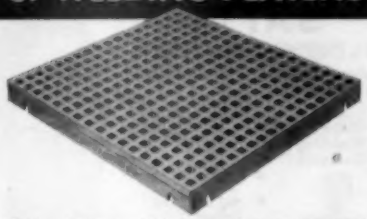

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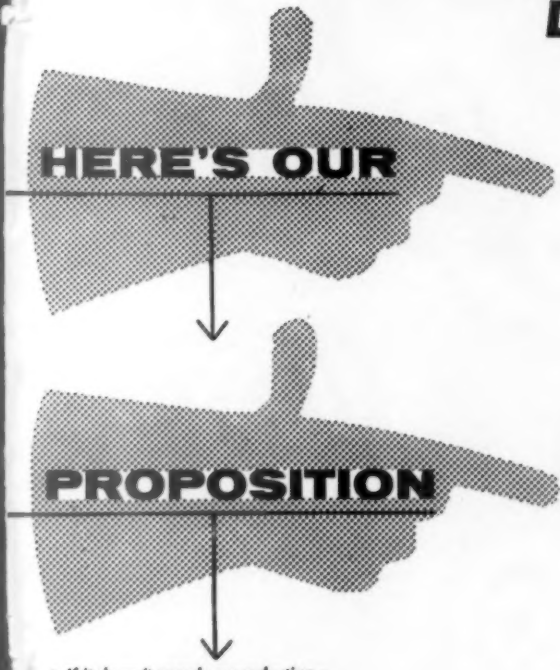


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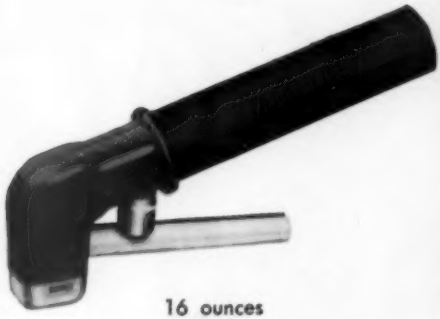

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